Popular Science



NARROW ESCAPES OF FAMOUS EXPLORERS

See Dies 11

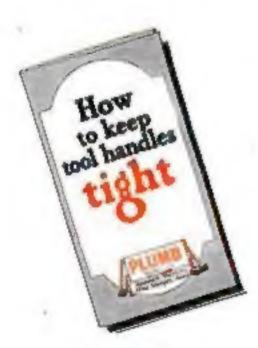
Hammer Heads do Loosen

But!

You can tighten a PLUMB

Just a turn of the screw makes it tight again





It's Free

Write for this free booklet telling the story of a remarkable invention that does away with looss handles on tools, WOOD will shrink. You know what happens to your chairs and tables.

It is the same with tool handles. Nomatter how tightly a new hammer is wedged—when the wood shrinks the handle will loosen and the head will wobble.

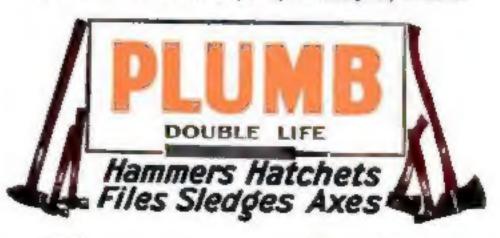
Plumb studied this problem for years. And finally solved it.... with a wedge that does this: When a Plumb handle loosens you take a screw driver, turn the screw wedge, - and your hammer is tight again.

That is all you do....just turn the screw and the handle is tight as new.

This remarkable invention does away with loose handles. It gives you a tool that is always balanced, always safe to swing.

All Plumb Tools (and no others) have this patented screw wedge. Good hardware stores everywhere sell Plumb Hammers, Hatchets, Axes and Sledges.

FAYETTE R. PLUMB, Inc., Philadelphia, U. S. A.



Copyriginal inargin

Thousands Can Now Enjoy Home Billiards

Brunswick Home Tables Moderately Priced-Sold on Easy Terms

Here's the opportunity of a lifetime to bring into your home the greatest sport of all-billiards. Show the family one of these attractive new Brunswick Home tables. Tell them of its modest price and the wonderful fun it provides—not for a short while but for years and years—and they'll be just as enthusiastic about it as you are.

Everybody loves billiards. There's a thrill to the game, a fascination—real competition. And besides the wonderful entertainment it affords, it provides mild, wholesome, health-building exercise.

You will get more real sport out of a billiard table in your home than anything you ever owned. Friends will flock to your house. It makes entertaining easy, for everyone plays or can learn to play quickly.

Read the description of the "Playmate" at the right. Note how little it costs to place it in your home. Then fill out and mail the coupon below for more complete information, pictures and prices on this and other Brunswick Home tables.

Don't miss this wonderful opportunity to interest the family in one of these tables. Write today.

The Brunswick-Balke-Collender Company Established 1845. Begaches in All Principal Cities of the U.S. and Canada

The "PLAYMATE"



A Genuine Slate Bed Brunswick Home Billiard Table

THIS newest Brunswick Home Lable is a modified standard table—ast a toy. It is substantially built and scientifically accurate. Cushions, playing angles and balls have been scientifically reduced to scale so that you have all the playing qualities of a standard size table. The slate bed assures an absolutely level playing surface. Folding legs enable you to set the Playmate up anywhere. It comes completely equipped ready for play - size 34 x 7 ft.

Price \$2650 down

Balance in small convenient monthly payments

At a slight additional cost interchangeable cushions may be had, making the billiards. Smaller tables, in sizes 214 x 5 ft. able at even lower prices.



The Be	THE PER	rick-l	lalke	-Co	Hender (Сомравл		
Dept	H-4	£83,	623	So.	Walmah	Avenue,	Chicago,	B

Gentlemen: Withour obligating me please tend your Catalog, giving descriptions, uses, prices, and also details of your cary payment plan on Brunswick Home Billiard Tables.



STRANGER THAN FICTION

AN EDITORIAL

"HE other day a writer of fiction assured me, in all seriousness, that truth is never stranger than fiction. He was wrong. Science proves it. Here, for example, are two stories that came to

my deak in a single day recently.

A laborer, seated on a box eating his lunch, playfully flipped a piece of cheese at a fellow workman. The cheese missed its mark and fell into a plating bath used in making copper disks from which phonograph records are stamped in wax. Disks from that bath proved to be much harder than those from others. Casein in the cheese, an analysis revealed, produced the increased hardness. Now casein is added to the solution used. More records can be made from a single disk than ever before and a considerable sum of money is saved each year.

In another plant a quick-drying lacquer was produced. But the liquid hardened so rapidly that it could not be applied with a brush. Caustic soda'was added to the mixture but the mass still jellied. Then the mixing machinery broke down. Pending repairs, the test material was left in the mixer for several days. When the experiments were resumed the chemists were amazed to find that the lacquer had become as thin as water. There, practically as it is marketed today, was the

product they had been seeking.

MONSIDERED as fiction, these stories would such strange twists of chance that much of our

scientific progress has come.

Röntgen discovered X-rays while studying electric discharges in gases. Pasteur laid the foundation for the germ theory of modern medicine while studying acid crystals. Our great paper industry has been developed from studies of the nest building of wasps. Perfumes, dyes, medicines, explosives and a hundred other things have come from investigations into the molecular structure of coal.

Scientific fact is usually dramatic and frequently whimsical. I have in mind a man who sought vainly to find a cause for the knocking in automobile engines. One day, in a different experiment, he asked an assistant to get him any colored chemical soluble in gasoline. Ten thousand chemicals were available and the storekeeper sent him iodine. It proved to have the property of eliminating knocking and was the only one of the lot with such power. From this somantic accident may come revolutionary changes in internal combustion engines.

IN THE struggle to make our lives easier, longer and happier that goes on constantly in our laboratories, there is real adventure, stories that are much stranger than fiction. Even the most skilfulliterary craftsman cannot make his stories more dramatic than are the unadorned and unembellished true romances of science. To prove it to yourself you need only turn over the pages of this magazine.

An invisible ray of light used to count automobiles! A motion picture machine that synchronizes sound and action! Foolproof airplanes! Devices to muffle the noise of riveting! An insect that can fly around the world in seventeen hours! "Beefsteak" made from cotton seed! Medicines from old shoes! These and scores of other things to make us gasp in amazement are told in this one issue of the

magazine

And-Herbert Hoover, who is seeking a fund of \$20,000,000 to promote scientific research, tells us that in science we have only just begun. In the 12,000 years that separate us from our ancestors of the Stone Age we have come a little way, not far So tremendous are the possibilities of the future that the human mind is no more fitted to grasp them than is a buildog to hunt rabbits -5. N. B.

November, 1926. Vol. 192, No. 5. Popular Science Monthly is published monthly at 2ks Voleth Avenue, New York, N. Y. by the Popular Science Publishing Co., Ipp. Entered as second-class matter Dec 25, 1925, at the Post Office at New York quiter the act of March 4, 1979, applicated entry as second-class matter at Chinese, Hilmain, Entered as second-class matter at the Post Office Department clausile. Printed to U.S. A. Copyright 1926, by the Popular Science Publishing Co., Inc., Single copy, 25 cents. Yearly subscription to United

States, its possessions, and Canada, \$2.30 foreign munitries, \$3. The contents of this magnifes must not be reprinted without permission. In presenting in its adjusted columns comercus stateles of new products of applied Science, Popular Science Monthly does not underwrite the business such help of the ingividuals or concerns producing them. The use of Popular Science Monthly articles for stack-relling schemes is never authorized. O. B. Capeo, President and Treasurer, R. C. Wilson, "Science authorized. A. L. Cale, Secretary.

The new Balkite Bat \$2750 and the new

Balkite Charger convert your radio set into a light socket receiver



Balkice Trickle Charger

MODEL K. With 6-volt" A" tinuous or trickle charge thus automatically keeping the battery at full power. With 4-volt butteries can be used as an intermittent charger. Or as a crickle charger if a resistance is added. Charsing rate about 5 umpers. Over 200,000 in use. Price \$10. West of Rockies \$10.50. (In Canede \$15.)



Bulkite Combination

When connected to your "A" battery supplies auto-matic power to both "A" and "B" circuits, Controlled by the filament switch on your set, Entirely automatic in operation. Can be put elther near the set or in a remore location. Will serve uny set now using either 4 or 6-volt "A" batteries and tequiring not more than 30 milliamperes at 135 volts of "B" current—practically all sets of up to 6 tubes. Price \$59.50. (In Canada \$81.)

All Balkite Hadio Power Unio operate from 110-120 coles AC current with models for both 60 and 50 cycles. The new Bulkete Charger is also made in a speclui model for 25-40 cycles.

To enjoy the convenience of a light socket set you need not discard your present receiver. Add the new Balkite "B" and the new Balkite Charger instead.

Balkite "B"-the unique "B" power supply-eliminates "B" batteries entirely and supplies "B" current from the light socket. The new Balkite "B"-Wat \$27.50" serves any set of 5 tubes or less where 67 to 90 volts are required. Balkite"B"-X at \$42" serves sets of up to 135 volts and 8 tubes, Balkite "B"-Y at \$69" serves any standard set.

The new Balkite Charger at \$19.50,*

with both high and low charging rates, is the most convenient of all methods of charging your "A" battery. At low rate it can be left on continuous or trickle charge. Thus it suromatically keeps your battery at full power. With heavy-duty sets, large sets, or sets in constant use whereexcessive "A" current is

required, a few hours'

rate quickly brings the battery to full charge. This new charger gives you the advantages of both trickle and high-rate charging.

Both Balkite "B" and the Balkite Charger are entirely noiseless in operstion. Both are permanent pieces cf equipment, with nothing to wear out or replace. Other than a slight consumption of household current, their first cost is the last. Both are built to conform with the standards of the Underwriters' Laboratories.

Over 600,000 radio sets - one of every ten-are stready Balkite

equipped. Add these two Balkite Units to your receiver now, Then you too will know the convenience of Balkite Light Socket Operation. Then you too will know the convenience of owning a radio set always ready to operare at peak power. Ask your dealer. Fansteel Products Combany. Inc., North Chicago. Illinois

Copyrigment inteleral

The Balkite Radio Symphony Concerts

with WALTER DAMROSCH and the New York Symphony

These concern will be broadcast every other Saturday Evening, beginning with October 23d. On intervening Sphurdays Mr. Damrotch will give a piano feeture recital alone. At 9 P.M. Eastern Standard Time, over a group of 12 stations: WEAF, WITH, WGR, WFI, WCAE, WSIA, WTAM, WWJ, WGN, KSD, WCCO, WDAP.

operation at the high #Balkite Charger \$20 West of Rockies. In Canada: Charger \$27,50;

Radio Power Units



The purpose of this new Department is to help Readers of POPULAR SCIENCE MONTHLY save money and invest it safely and profitably

How Mr. Davis Increased His Income

If you have money in the bank you can nearly double your income from your savings just by reading this page and following Mr. Davis' experience

By WALLACE AMES, Financial Editor

MR. DAVIS had just spent a very profitable half hour with the sales manager of a prominent firm of first mortgage bankers. He left their office richer in dollars and richer in wisdom—he had found a safe way to invest and make an extra \$240 each year on the amount he had laid by. Without doing a stroke of work Mr. Davis nearly doubled his income from his savings. What Mr. Davis learned from the sales manager should help every reader of Popular Science Monthly to make progress in getting ahead financially.

"Your company is one of several," began Mr. Davis, coming at once to the point of his call, "who claim that no investor has lost a dollar. I have a special reason for wanting to know how this perfect record has been made.

"MOST of the money I have made is tied up in my own business. But I have a few thousand in the bank drawing 4% and the first endowment policy I took out years ago is now maturing and that will give me five thousand more. I have at least twelve thousand now that I do not need in my business.

"As I figure it I would get \$240 a

year more interest by investing in your bonds, but I worked hard for my money and am not interested in taking any chances with \$12,000 to get a possible \$240 more a year. Your 'no loss' record must mean that your bonds are safe, and I suppose that should be recommendation enough but I want proof in facts. I would like to know why your bonds are so safe that no investor ever lost in them.

"That's easy to explain," began the sales manager. "You see, all our mortgage loans are made on an amortized basis. The borrower.

borrower"
"Hold on," interrupted
Mr. Davis. "That's all
Greek to me. I'm in the
cotton goods business. If
you were talking about

converting and factoring, about looms and spindles, I would be right with you, but when it comes to bonds you will have to cut out technical terms."

"All right," returned the sales manager, "let us imagine we are two other fellows, one trying to borrow money from the other; imagine a conversation like this taking place:

pay you in six months with interest."
I have the money, Bill, but what

do you want to borrow it for?"

"Want to buy a Ford. I have a chance to get a good paying position traveling through Vermont and New Hampshire, but the trains are so infrequent that the man who gets this job must have a car to cover the territory."

"I'd like to help you out, Bill, but I will be needing this \$500 later. How can I know that I will get it back?"

"Well, I'll give you a chattel mortgage on the car and let you hold the pearl studs and links my grandfather willed to me. They alone are worth more than \$500. How about that?

"That shows good faith on your part, Bill, but if you were unable to pay me back in six months I would not want to keep the study and Ford in place of my five hundred. What I want to know is, how can I be sure you will have the money when it is time to pay me back?'

THAT'S casy, Jim. I can make \$100 a week on this new job. Mary and I are now getting along on \$75. I'll put away \$25 every week In six months that will amount to—let's see—why it will amount to \$650, more than enough to pay you back with interest. Do I get the loan?

"Not so fast, Bill. Your intentions are good, but money is money. How would I be sure you would put the money away every week, that you would not dip into it occasionally when you wanted something extra?"

"Jim, I am perfectly willing to give you an order on my employer. You can get the money from him out of my pay every week. And you can hold the mortgage on the Ford and keep the pearl studs until the last cent is paid back."

Now you've made a real proposition, Bill, and I will loan you the

\$500.

"If it was always as hard as that to borrow money," observed Mr. Davis, as the sales manager paused, "there

would not be so many people trying to get loans from their friends."

"But you get the point, do you not, Mr. Davis? You see this fellow, Bill, not only wanted the money for a useful purpose-to put himself in position to make more money-not only did Bill offer security, but he agreed to pay back the loan out of his earnings. And on top of that he agreed to have a definite amount taken out each week and paid over to Jim by his employer. That made the deal pretty near air-tight." "Yes," re-marked Mr. Davis, "Jim had it figured out nicely. He was a careful business man as well as a friend of Bill's."

"And that is one way of showing how our bonds

HOW TO GET AHEAD

THIS new Department is to help readers in the establishment of proper financial programs at the beginning of their business careers; it assists those who have secumulated money in the proper investment of it so that it will be safe and so that it will grow,

The Editor of this Department is an authority on investment matters and he will not only every month give the renders interesting and useful information in his articles, but is also ready to aid in personal investment problems. Advice will be gladly given regarding the proper investment of funds and proper plans of saving. Address all your inquiries to Wallace Ames, Financial

Address all your inquiries to Walface Ames, Financial Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York.

Any advertising appearing in this section will be carefully investigated by the Publisher of POPULAR SCIENCE MONTHLY. Readers can be sure that companies advertising are reliable and that they offer securities which represent sound financial investments. While investments obviously cannot be guaranteed by the Publisher, every effort will be made to insure that only advertisements of absolutely reliable companies are accepted.

Address your letters: Wallace Ames, Financial Editor,
POPULAR SCIENCE MONTHLY, 250 Fourth Ave., New York

How Mr. Davis Increased His Income

(Continued from page 4)

gresafe-guarded against possible loss," continued the sales manager. "The mortgaged property itself is able to earn money to pay interest and repay the bonds and these earnings are pledged in writing and paid over as they are collected by a carefully worked out plan. That is to say, the building pays its own way out. Here's a typical bond issue. See how these safeguards are put in."

The sales manager picked up a circular describing a certain bond issue and resumed: "This bond issue is on a new aparement building which, together with the land, is worth more than \$1,000,000. The net income from rents should be over \$125,000 a year. We loan the owner \$700,000 and this is

what he puts up as security:

"First, he gives a first mortgage on the land and building worth \$300,000 more than the amount we loan him.

"Second, he agrees in writing that the carnings of the building shall be used to meet interest and pay off bonds before he uses any part of the earnings for other purposes. So we practically have a moregage on the carnings as well as on the property itself.

"Third, we arrange a schedule so that the borrower must start the second year to pay off an average of \$30,000 in bonds annually. By the fifteenth year he has paid off \$390,000 out of an original Joan of \$700,000. But still we have a first mortgage on the entire million dollar property.

"Fourth, since rents are collected monthly, we require the borrower to make monthly advance payments instead of letting him wait until the interest and bond payments are actually due. And these monthly payments are made to a third party called the trustee who acts in the interest of investors who have bought the bonds. That is like Jim loaning money to Bill, and collecting from Bill's employer.

"As this loan is for \$700,000 we Essue \$700,000 worth of bonds in \$100, \$500 and \$1,000 amounts. That gives every one a chance to invest the amount he has available in a security which would otherwise be open only

to the millionaire.

"Of course there are a lot of saleguards I have not mentioned. We look up the borrower carefully and make sure he is capable, honest and strong financially. We get expert opinion as to the value of the properry, its probable earnings under whatever conditions may arise, find out if there is a real need for that particular building, etc. The title is insured, fire insurance taken out in favor of the bondholders, and we check up regularly to see that taxes are paid. We have been in this business a good many years and we naturally have a complete organization of trained men to look after every detail."

.... And that is how Mr. Davis spent a very profitable half hour. He learned that the modern type of first mortgage real estate bonds have not only the old fashioned first mortgage behind them, but that the rental income of the property is also pledged as security and this income as paid over to a trustee as soon as it is collected by the property owner. Now Mr. Davis is a first mortgage bond investor. His money is safe and he is getting \$240 more interest.

Jouble Clean

Make the Twice-Over A Once-Over

THE Gem Double Life Blade gives a doubleclean shave in half time! Its double-keen shaving edge gets the hair at the dermal line the first stroke! Doubleheavy, double-reinforcedit never flexes, quivers, or scrapes. Double-durableit keeps giving brand-new shaves long after other blades have expired! Made of better tempered steel, it leaves you in a better temper after the shave!

It's double-protected, double-sealed, and it's backed by a double-satisfaction guarantee. Sold everywhere.

P. S .- Your money does doubleduty when it buys the Gon de Luxe Razor. And to make sure that every Gem owner is doublehappy, our service department will make good for any frame that isn't 100% perfect—no matter how long it's been in use. Send it to

GEM SAFETY RAZOR CORPORATION Brooklyn, N. Y.





Booklets for Men who Want to Get Ahead

THE booklets reviewed below will assist any investor to get ahead mancially. You may obtain any of them, without charge from the issuing house, by writing the Financial Department of Popular Science Monvelly, 150 Fourth Avenue, New York. For convenience usk for chem by number as given below-[1] "How to Build an Independent Incides" (The F. H. Smith Company) presents a modern way of saving money, explains how first mortgage bonds may be purchased by monthly deposits, and presents tables showing results attamable by carrying out their plan for a period of years. [2] "DIVERSIFICATION AND VIDELANCE" (A. B. Leach & Co.) presents a brief analysis of seven basic principles that assure success to the management of personal lovestments INCREASE YOUR INCOME 15% to 60%." (The Adair Realty & Trust Co.) explains how the investor the get 636% on money now carning 4% or 5%, on guaranteed mortgage bonds.
[4] "FORTY-FOUR YEARS WITHOUT LOW TO ANY
LEVISTOR" (S. W. Straus & Co.) presents the safety record of this bouse and describes the safeguards constituting the Straw Plan-[5] "SAPE BONDS FOR INVESTMENT" (Halsey,

Stuart & Co.) presents their current list of divensited investment offerings, with instructive [6] Eva Witzens Terrimont" (Trust Company of Florida) reprints letters from investors, telling in their own words their experiences with, and their opinion of the service and mortgage boods offered by that Trust Company.

"How to GROW AND HARVEST DOLLARS"
H. O. Stone & Co.) describes a savings-investment plan offered by that Conguny, and describes how to accumulate from \$4,603.15 to \$46,042 47 by monthly investment of from \$10

[6] "AN INVESTMENT PASCRED FOR ITS LITETIME (Mortgage Security Company of America) describes their plan of insured mortgage investments. Nine points of safety are explained.

9 RULES FOR SAPE INVESTMENTS (Published by American Bood & Morreage Company) explains in language that the layman can understand the emportant factors of safety of real estate bonds.

[10] "BUTING BOSIOS BY MAIL" (A. C. Allyz and Company) explains how the investor may safely and conveniently deal with an investment banker through the mails, and without the usual advantage of direct contact.

[11] "Youn Masaer" (Fidelity Bond and Morrgage Co.) covers the points of general interest to the investor who is planning to pur his money in sound mortgage bond investments.

investment comment.



TESTS OF RADIO APPARATUS

KEY TO ADVERTISE-MENTS OF APPROVED RADIO PRODUCTS

Page
All American Radio Corp. 7
Allen Brailley Company
Amplion Corp. of America (1)
Belden Manufacturing Co
Burgen Battery Company 124
Carborundum Company
Carter Radio Company 92
Central Radio Laboratories, 114
The Chaslyn Company 94
Day-Fan Electric Co. ,
Daves Radio Company 130
Dubilier Condenser & Radio Corp. 118
Fantteel Produces, Inc
Chas, Freshman Co. 4th cover
George Electric Co. 98
A. H. Grebe & Co 8
Grigsby-Grunow-Hinds Co 83
Hammarlund Mfg. Co 132
Hawkeye Radio Company
Jefferson Electric Mfg. Co 81
Kodel Radio Corp 115
The Kurz-Kasch Co
Arthur H. Lynch, Inc 168
Glenn L. Martin Co
Martin-Copeland Co 72
Metro Electric Co 87
Midwest Radio Corp 3rd cover
National Carbon Company 85
Prest-O-Lite Cumpany 92
Priess Radio Corp
Radial! Company
Radio Corp. of America 69
H. G. Saal Company, 115
The Sterling Mig. Co
Westingale Electric Mfg. Co 112
Westinghouse Electric & Mlg. Co. 129
World Battery Company 214

by University Engineers Insure Satisfaction to Radio Buyers

ALL radio products advertised in Popular Science Montelly must be approved by the Popular Science Institute of Standards. On the left is an index to the advertisements of certified radio products to be found in this issue. None of these advertisements contain misleading or incorrect claims. Each statement is guaranteed correct—each product is guaranteed by Popular Science Montelly to give satisfactory performance.

"What kind of radio apparatus should I buy?" This question is uppermost in the mind of everyone interested in radio. To answer this question for its readers, POPULAR SCIENCE MONTHLY two and a half years ago established the Popular Science Institute of Standards under the direction of Professor Collins P. Bliss of New York University. The work of the Institute is conducted in the Sage Laboratories where the most modern equipment is available for thorough testing of any kind of radio apparatus.

By means of the exhaustive tests made by the Institute of Standards, readers of Popular Science Monthly can purchase radio apparatus advertised in its pages with complete assurance of satisfaction and quality. Readers will find the Institute's impartial advice of greatest value in

eliminating guesswork and uncertainty in the selection of radio apparatus.

In selecting products approved by the Popular Science Institute, readers know they will get articles of sound quality, efficient construction, and capable of standing up under usage. The service of the Institute is entirely free. Address inquiries, or requests for the list of approved products, to the Popular Science Institute of Standards, 250 Fourth Avenue, New York, N. Y.



Popular Science Monthly GUARANTEE

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Science Monthly may expect them to give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly.

THE PUBLISHERS



— remarkably good/"



ALL-AMERICAN Constant-B Battery Eliminator

That is the judgment, without exception, of radio experts and enthusiasts who have examined and tested these two fine units.

They mean better reception. Both have a great deal to do with finer tone-quality. You owe it to your own enjoyment of radio, to know the facts about these fine-quality accessories.

ALL-AMERICAN Reproducer

For purity of tone this handsome product is outstanding among reproducers. It combines ingeniously all advantages of good cone-type reproducers -and the improved quality provided by a special sounding board and sounding chamber. A highly sensitive unit which reproduces voice and instruments naturally and clearly. Perfect uniformity is maintained over the entire musical range, whether amplifiers are turned to full volume, or down to a whisper. Absolute freedom from "inherent pitch" prevents low throaty tones or twangy nasal effects.

Price \$25.00

ALL-AMERICAN Constant-B

An attractive compact unit of silent efficiency -insures a dependable supply of uniform plate current. Five output taps; negative, +45, +67, +90, and a power tube tap adapt "Constant-B" to all requirements. A "Detector" control provides voltage variation between 10 to 60 volts. An "Amplifier" control allows a variation of 10 to 120 volts on the intermediate tap, without affecting the 90 volts supplied to first audio stage. A High-low switch adapts "Constant-B" to receivers of various current requirements.

Price \$37.50 Complete with Raytheon Tube

New 1927 Radio Key Book

Learn more about the fundamentals of radio. This new 48-page book contains an interesting analysis of radio in language anyone can understand—also complete constructional details of the leading types of circuits. Sent for 10c (coin or stamps) to pay for postage and mailing.

ALL-AMERICAN RADIO CORPORATION

4205 Belmont Avenue, Chicago, Illinois

STATION OWNING AND OPERATING WENR MATERS

Have You Heard It?

UNTIL you hear the Synchrophase you will not realize how perfect radio reception can be.

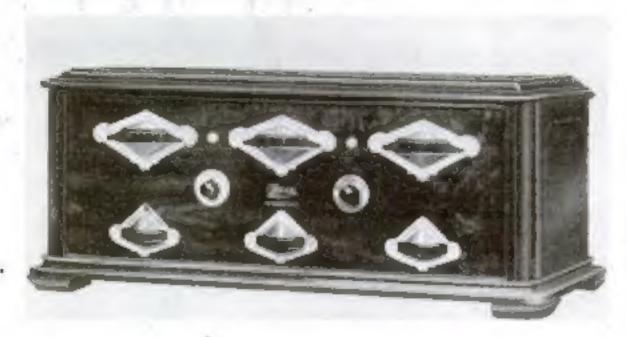
Your dealer will demonstrate the several very definite reasons for the superior reception of the Synchrophase:

—Colortone, Binocular Coils,
S-L-F Condensers, Low-wave
Extension Circuits, etc.

Or send for Booklet P.

A. H. Grebe & Co., Inc., 109 West 57th St., New York Western Branch: 443 So. San Pedro St., Los Angeles, Calif. Factory: Richmond Hill, N. Y.

This company owns and operates stations WAHG and WBOQ; also low wave rebroadcasting stations, Mobile WGMU and Marine WRMU.



The Synchrophase is also supplied with battery base.



"Do not take merit to yourself; then it will never be taken from you."

The makers of the Synchrophase endowed it with its virtues; its users conferred on it the praise it enjoys.







All Grebe apparatus is covered by patents granted and pending.



POPULAR SCIENCE MONTHLY

SUMNER N BLOSSOM, Editor November, 1926



It Ruins Your CAR and Costs You MONEY

Bootleg OIL

How unscrupulous dealers sell you inferior substitutes, endangering your car and even your life—Ways you can protect yourself

By Myron M. Stearns

OWN a concrete grade in New England one day last summer a small touring car rolled garly. At the wheel was a maidle-aged man life wafe sat beside him four children filler the tonneau. Baggage and camping outfit on the running board proclaimed

them through tourists. With no other car to sight, the head of the family let 'er flicker right along was dosing all of forty at the foot of the grade, and for the pert rise he opened the throttle wide.

Not far away, in an adjoining clump of woods, I was lisking along a path leaning to my vacation camp, when I was startled by the shrick of granding metal, panetuated by the crash of breaking steel. I raced toward the highway.

What I naw was trage The small car had come to an abrupt stop, and the owner at.Il sat at the wheel, apparently at meter at the catastrophe. Broken pieces of connecting rods scattered over the road, smashed crank shaft, sensed pistons, and rasped cylinder block had, to a fraction of a second, converted a pleasant outing into a bill for repairs that would mount into hundreds of dollars. A casual examination of the jammed and "frozen" parts of the wrecked motor was enough to reveal the story of what had happened

Another car, and another family, had fallen mnocent. victims of bootleg and

Bootleg oil! It is the name of a new and gigantic

scareful that has come upon us all unnoticed, picking our pockets, increasing repair lalis, robbing us of motor car satisfaction, and even endangering our lives. It is a semudal that is costing year and me and other American automobile owners nearly a billion dollars a year in

unnecessary expense. What does it mean?

It means that at least once out of every five times that you purchase oil at a roadsde filling station you will not get the kind of oil you ask for. Possing you may get another of not as good, but the chances are that the stuff poured into

used oil from some other motorat's cante case, that endangers the bie of your

your crank case will be a low grade an batitute, or adulterated oil, or even

THIS is not a guess, nor merely an opinion. It is a proved fact, established by resent anthorstative investigations concreted in various parts of the countev anvestigations which have brought startling revelations of a nation-wide graft in laborating oil.

medicial form of presey springing up by the roadride to unperal and rob you and your family at every tirn. In many cities the investigations are stingoing on. Today they are unpressing on us the warning loat ucless we exercise exin caution whenever we purchase oil, any one of us, at any time, may find ourselves in the same predicament as the family of mo-

They have revealed an

Inf side. Think of it! At least one chance in every five that the service man may fill your car with a substitute lubricant, and that this substitute may be one that

torista which I saw conic to grief on the New England

What Poor Oil Does to Your Car

It causes excessive wear and tear on every moving part.

It may emash the connecting rods; break the crank shaft, "freeze" the pistons, ruin the cylinder block, or bring on any number of troubles that mean big repair bills, or even dangerous accidents.

It "gams up" the exhaders and other moving parts with foreign matter, carbon, and splinters

It overheats your engine and makes it noisy. It takes all the enjoyment out of motoring. It sends your car to the junk heap long before its time.





Blames Dishonest Dealers Presiding Justice George W. Simpson of the New York Commercial Feault Court says Bootles olds forsted upon motorists dom age cars to estent of \$1 000,000,000 a year "

will damage or even ram the finely adposted machinery! And this, as the myestheathous have revened, is a conservative estimate. In some places it has been formal that the character of getting a subatitute or suferior oil in place of the real atuil you ask for are three or even four out. of five. In other words, according to the investigators, it is portting the situation mildly to say that twenty-five percent of all the automobile oil sold to you and other motorists in this country is found idently inferior.

INDEED, to such alarming proportions for the alliest traffic assessment that the has thu illiest traffic grown that two states recently have passed laws making it a cruminal offense for any dealer to fill an order for labracating oil for an internal combistion cogne with a substitute or spurious article. Storing laws will be placed before the legislatures of forty-two states for action early next year.

Perusps, until now, you have gone along without realizing that femiliarit e | 5 so widespread that it constitutes a national menace to motorods. I, for one, had it brought home to me a few weeks ago when I was driving an isit car through Pennsylvania. I happened to notice that. at a speed of thirty it i.es an hour, the oil pressure gage on the dash registered only four or five pounds, whereas at that speed it should ordinarily read twelve or thirteen. I stopped and looked at the gage on the motor. It indicated that I needed more oil, so I pinled up at the next service station, a red gasoline pump nutside a small grocery storn.

"Give one two quarts of medium," I told the proprietor. (I am using the name "Bearcat" here for that of a widely known motor oil.) Then I went into the store to make some small purchases from the perprietor's wife,

HIVING pand for the top-grade of I drove on again. Imagine my we tanishment when I found that the oil gage on the dash registered just schol it had before, between four and live pounds! This convinced me that the oil did not have the proper thickness or body. So, as soon as I reached a filling station that I knew to be reliable, I had

the crank case drained and refilled with good Bearcat medium. And driving away from there the dash gage rose to filtern before I had reached a speed of

thirty miles!

If you never have had such an expersence, probably you will be inclined to doubt that the dangers of damaging your car by bootleg oil are as real as they have been pictured. If so, you may be automished at some of the facts recently brought to light by the American Fair Trade League, a non-commercial organination of business men from all parts of the country who have bunded together to promote Jaar psay and honest dealings in bunness. Not long ago these men sponsored a trip of investigation through the New York metropolitan district and the purchase of samples of oil from forty two filling atations. In each case the investigator asked for a certain well-known brand,- the one, let us say, which we have been calling "Bearcat," The same ples then were taken to the laboratory of Henry James Masson, assistant professor of chemical engineering at New York University, and there thorough s mandy zeel

"I'ME results were startling. Of the I forty-two samples collected, only were were found to be genuine "Bearcut." The rest were substitutes or mixtures. In other words, only twenty-one percent came up to the "Bearcut" specifications. seventy mine percent were frauda. Only one dealer out of five supplied the oil which had been ordered. Mour out of five sold substitutes'

When the matter was called to the attention of the New York legislators, a representative of the Bureau of Weights and Measures was sent to make a round of service stations at Albany, the equial city. Fifteen calls were made at stations selected at random. In seven cases the investigators were told that the staturns did not earry the brand of oil requested. Two stations out of the fifteen sold the genuine oil called for. The remaining half dogen supplied stuff (for the price of the genuine article) which analyan proved to be bootleg. Subsequent prel manazy investigations made in Philadelphia, Chicago and Detroit indicated that conditions in those esties were as bad as at Albany

"B'T just what danger is there in this inferior oil, and what serious damage can it do to my car?" you may ask. An answer was given in Popular Schner. MOSTRLY some time ago by one of the luggest automobile junkmen in New York (ity is man who team down handreds of

disentded cars every year

"There are a mimher of good reasons why cars don't stay longer in the zonning, but the first one is poor lubrication not only lack of oil, but lack of grant on If you could see all the worm bearings and gears and frozen pistons that I do, you discon understand how important it is to have your ear well beeled with highgrade oil. The poor stuff hasn't any body It samply turns thin like water when it gets hot.

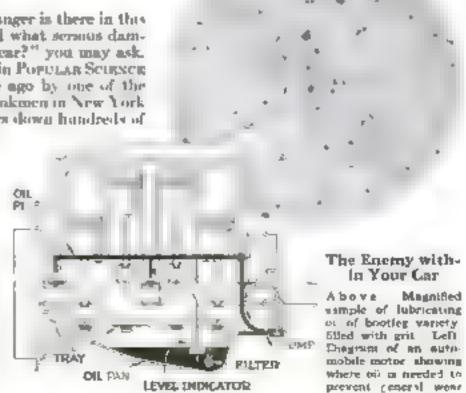
Your automobile is a mighty complirated and delicate contraption. Putons are flashing up and down at theredible speed, driven by a series of explosions so rapid that the human ear can hardly distinguish between them. Crank shaft and flywheel, with the connecting rud bearings that take the push of the explossins, are whirling at perhaps twolve or fifteen hundred revolutions a minute. You throw in the clutch, step on the accelerator and while down the road twenty or thirty miles an hour-yes, sometimes fifty or more—in absolute reliance on the continued safe operation of that complicated mad me

Did you ever stop to think that it is od, and oil alone, that makes it possible for that molor to contract to run? Or that the thru, shippery blue of Librarius. between the whiching steel parts is adthat presents those parts from clashing, gending and locking together?

This of this is made up of countless ting increased establish net an amorela the same was as the onds in a ball bearing. They serve as roller supports on wheli the metal parts can turn about our another at high speed without coming in actual contact. In other words, the oil is the thing that prevents friction.

NOW what happens if this film gives out or becomes too thin? If you over have tried to bore a hole through a piece of metal and burned your fingers on the drill which has become heated by the friction, you can understand something of what happens. The moving steel parts, granding in contact with ore another, minediately get hat. This heat expands them unto they had together. They "freeze," then, with the power of the engine explonors still exerting a push, semething is bound to give way. Something has to smash, whether it be a counecting rod, counk shaft, genr, or what not.

If the break comes in the motor or somewhere in the center of the nuchair,



you may brake or coast to a rafe stop. On the other hand, the break may result in a twist that changes your direction suddenly Then you may find yourself in the ditch.

Suppose, again, that the oil, while not actually breaking down and causing a "freeze," it of such quality as to offer flimsy support. In that case the damage, while not so immediately apparent, is none the less real. The effects of poor grade oil on your automobile motor are always the same excessive wear and

rapid deterioration.

Not long ago the engineering department of one of the largest oil companies staged a scientific test that showed startlingly just what happens when you use poor oil. The engineers took two brandnew motors and set them up on test benches. These motors were identical in construction, but the crank case of one was filled with medium motor oil of high grade, while the other was filled with the kind of oil you buy at a "gyp" service atation.

BOTH motors were started at the same time and kept running for several hundred hours. At the end of that time they were stopped and dismounted, and the wearing parts were measured and weighed. It was found that the motor filled with good oil had worn so little that the actual amount of wear hardly could be determined. In the motor run with poor oil, on the other hand, bearings were loose, cylinder walls showed traces of burning and scoring, the compression was weak, carbon coated the cylinder head in a thick layer, and the valves were gummed up and pitted.

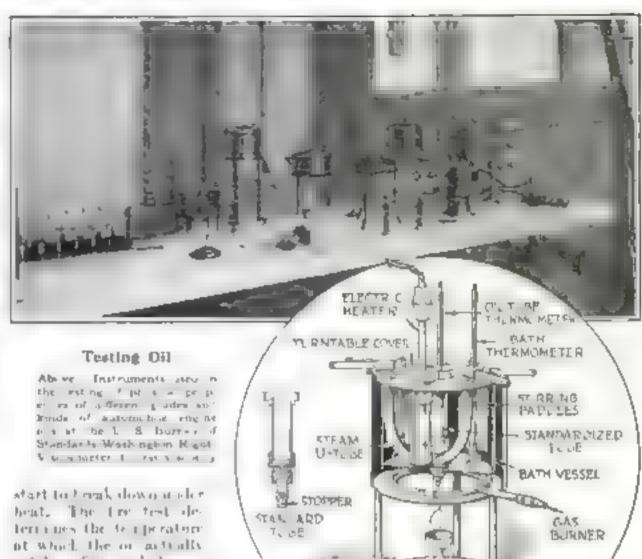
The condition of these two motors was evidence enough of the dumage caused by poor oil; but to make the test still more convincing, the engineers cleaned both motors, reassembled them, and started them going again. This time, however, the oil supply was switched around so that the worn motor got the good oil, and the poor oil went into the erank case of the motor that had gone through the first test almost unseathed. The run was continued for the same length of time as before and then the measuring, weighing

and testing were repeated.

This test conclumively settled the ques-Hon. The motor that showed severe wear after the first test now undicated virtually no additional wear. The good oil had prevented further damage. The other motor, the one that had passed through the first test almost unharmed, now showed excessive wear and deterioration. The bootleg oil had done its work!

JN PROFESSOR MASSON' S labora-▲ tory analysis of the samples of oil taken from forty-two filling stations in New York City, five important points were considered in determining the lubricuting qualities of the oil. These were specific gravity, flash point, fire test, pour test, and viscosity. Considered together, these tests tell whether or not the oil you buy will "stand up."

Specific gravity, of course, indicates relative weight of the oil. The flash point is the temperature at which vapors from the oil will momentarily ignite (as in the "popping" of a gas burner), in other words, the point at which the oil will



STRA WER

rat has fire and burns The pair test determines the degree of cold at which it will still pour amouthly, in other world, measures the ability of the oil to reant cold without becoming shuggish and failing to

spread between surfaces requiring laber-

Viscosity is the thickness or "body" of the oil. This means the ability of the oil to stay in a bearing and result being squeezed out by pressure.

For the standard, high-grade oil which each of the forty-two dealers was asked to supply, the specifications ran as follows.

Specific gravity	(Injuly a vession						
Flash point	Take termina →						
hire test	140°F (minimum						
Pour test	To F Cipacipingin						
Vacualty	495 per Caverage						

With these figures compare now the findings for the substitute ods which you will recall, were sold by thirty three out of the forty-two dealers in place of the genuine standard article called for. The measurements of the substitute samples ranged as follows

Sperific gravity 890% to .8500 B 80 F Or 429 F Flesh point 480 F to 47 F Fire test ... 20°F to 40°F Pour test Ymeunity 191 etc. to 574 sec.

Take the viscosity range alone. Of the forty-two maples, only two showed a "body" above the specified 495 of the standard preduct. The body of some of the bootleg oils can as low as 191. That means, roughly, less than half as thick as the reliable oil, and with less than half its Jubineating quality

Or compare the figures for flash point and observe that some of the substitute oils begin to break down at a temperature 45 degrees lower than the reliable oil asked for. The same relative con-

dition in true in the case of the fire test. Some of the substitutes burn at a temperature forty degrees below that at which the high grade oil will still do its work efficiently. You can readily realise what the effect of such a condition would be in case your eaging abould become heated to chimbring a hill, or the water so ald run low in your radiator. Where the good of wood stand up under the mereased heat, the pour oil raght bern and break down, faring forther to lubracate the bearings and cours ig either a had smash or, at best, damaging wear and a costly repair bill.

And this damage and wear to your antomobile is not the only loss. You are actually paying the top prices of highgrade oil for cheap, low-grade substitutes. You and every other motorist today are literally being robbed to fill the pockets of a thousand roadede dealers, unsupervised service men. They are a t-concerned with your safety—and your own techmeal ignorance about oil gives them their claimes. So the greed of the unscruppions mosority, that infests every trade until an awakened public curbs its illegal netivities, has developed this astonishing new system.

THERE exist cheap, low-grade oils. without necessary body for safe lubraeation which these "gyp" dealers can bey for prices as low as fifteen or twenty cents a gailon. By selling this stuff to you at twenty-five or thirty cents a quart, under the guise of a standard brand, these dealers make anywhere from 400 to 700 percent profit! And, even if a "gyp" merely makes a half and half musture of one of the cheap (footinged on page 129)



Famous Stomachion of Archimedes Will Challenge Your Wits-Try It and Win One of Our Cash Prizes

POPULAR SCIENCE MONTHLY presents on these pages the Stormenon of Archimedes, one of the most fascinating puzzle games the world basever known. Recently resurrected out of the dust of twenty centuries at promises to become even more popular than the cross-word passines that have captavated America and other countries in the last few years.

Or guiated by Archimedes, the famous Greek mathematician and inventor who hved at Sycacose in Sicily, in the third century B, C, for centuries this absorbing game was played and enjoyed by the ancient Greeks and Romans. Completely lost to the world during the Dark Ages, the inventor a description of how it should be played now has been discovered in an ancient parchiment, and muste available to the world through the research of Doctor R. D. Oldham, a famous British geologist.

The ancient Greek name for this remarkable game, Stomachion, means "the thing that drives one wild." And people who have tried it, including a number of noted Americans, my that the name fits perfectly. Once started, they say, it is almost impossible to leave it until its peculiar problems have been

For pure him, it is a game that anyholly will enjoy, yet it is scientific enough to challenge the keenest mands. You can

play it as solitaire or with any number of

Fourteen bits of cardboard cut on a scientifically worked-out pattern in specified shapes that, fitted together, form the rectangle above. With three pieces, as Archimedes (above) told the anceints, you can make any seasal, bird, busines agure or object you want. Sounds simple? Try it?

The lateen-rigged alum, for example or or other states.

others in competition. It is packed with surprises. And as an entertaining means of stimulating the mind and training the eye to keener perception of line and form, it probably has no equal.

The game consists of fourteen small pieces of flat eachboard or wood, which you cut note specified shapes, most of them transfer. These pieces, properly arranged as in the diagram above, fit together to make a perfect rectangle exactly twice as long as it is wide. The fourteen pieces can be rearranged to produce many thousands of original figures, resembling men, animals, bouses, birds, ships and countless other objects. The variety need only be limited by the skill of the player

You simply take the fourteen bits of board and fit them together as best you can into a recognizable figure. The object of the game is to see who can build the most lifelike and original figure. The

examples on these pages demonstrate some of the possibilities. The lateen-rigged slip, for example, shows how you can ensisting the smaller pieces to form larger triangles or rectangular shapes. Human figures can be made amazingly lifelike and full of action. Study the charging soblice and the blacksmith, and note now anugly and accurately the pieces fit together. Two particularly fine action figures are the baseball players at top of page 15, which were designed for Popular Science Mosciene by Arthur L. Smith, a noted authority on pussles and games

A BORED expression—a look of dignity, wildness, surprise—all these, you will find, you can give your human figures by the skilful placing of one bit of cardboard! This matter of getting the right "facial expression" on your human figure becomes sometimes the most exasperating problem of all!

In designing an animal, perhaps the most ticklish part you'll find to be getting the right proportions. Ears a trifle too



Here are a few ingenious figures created from the Scottschion by R. D. Otdham, the English peologist who resurrected the famous game, and

others. The game is not to copy these, but to originate new figures of your own. Each figure must use every one of the fourteen pirots



Two striking action figures. Note the

long will make your ent look like a do skey, and a back too humped will give your borne the look of a hippopotamus! To start out with the intention of creating a whippet and finish with a nice old cow may be human but is certainly a confession of weakness. Nevertheless, many a Stomachion musterpiece will doubtless be produced that way!

THE pieces for the game can be made from wood, wallboard, cardboard or any other similar material, but in the beginning perhaps it would be best to use a bit of good quality cardboard that can be cut easily. Here's the way to go about making the puzzle.

First lay out and cut the pieces. This is a simple matter and should not take more than ten minutes. Follow the diagram on page 12. On thin wooden board or a piece of stiff earthoard, draw an exact rectangle, just twice as long as it is wide, represented in our diagram by ABCD.

Next, mark the middle points of the top and bottom lines of the rectangle, thus fixing the points marked E and F on the diagram. Now draw the line EF and the diagonals AD, CE,

and ED, fixing the point G.

You will see that the rectangle is now divided into two equal squares. Taking first the left-hand square, halve the line AG, thus fixing the point H. Draw the line CH. Then bisect the line CF, fixing the point J. Bisect also the line CG, obtaining the point K; then bisect the line KG, fixing the point L. By drawing the bias JK and JL, connecting these points just determined, you complete the construction of the left-hand square of the rectangle.

TI RNING next to the right-hand square, which is already traversed

by the two diagonals, ED and AD, bucct the diagonal ED, thus fixing the point M. Then draw the me FM. Bisect the vertreal line BD, fixing the point N, and then further breet the line BN, fixing the point P. Drawing the lines MN and MP compieter the construction. The points R and S are fixed automatically by the intersection of the lines, and do not take part in the construction.

All that remains now is to number the fourteen

Make a Stomachion of Your Own and Win a Prize!

PUPULAR SCIENCE MONTHLY offers
from in each prizes to those renders who
submit the best original designs of unimal
figures made from the fourteen pieces of the
Stomachion of Archimedes, described on these
pages. Prizes will be distributed as follows:

First Prize	. ,	,	,	_	į.	_	η.	\$25
Second Prise .	+							4.5
Third Prize								20
Five Prizes, \$5 each								25
Ten Prizes, \$2,30 each	ļ.		4			_		35
Total Prines								State.

While it is possible to create many other kinds of figures, for the purposes of competition we are low any insparent communa, topices,
the hypre construction as near separate or net
as he decrees. In the construction of your
figure, all tourteen pieces must be used

The pieces may be used in any position desired, even turned over on their reverse taces, provided to it form and lancosons are use altered. Each price min the numbered according to the numbered chagram on the opposite page. Our ron of the judges will be tassed in the originality and life iter har acter of the figure, and on neutries and skill a present a too. The sole to leave in the contest will be the Board of he are of Pertrak Science Violent y and their fections will be final. In case of ties, the full answer of he price will be given to each tying contestant

You need not hav Popular Science Montelly to compete. You can borrow a copy from a friend or you can examine one at any fice of Popular Science Montelly or at

public libraries free of charge.

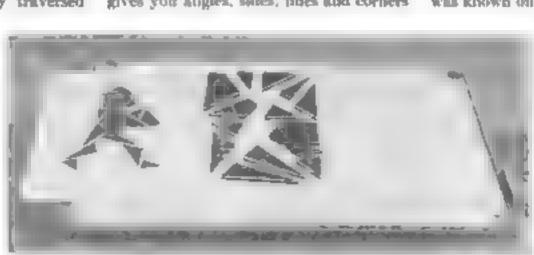
All entries must be mailed or delivered not later than November 30 to the Paulle Editor, Popular Science Monthly, 230 Fourth Avenue, New York Co.

pieces as indicated in the diagram, then cut them or naw them along the lines you have drawn. This done, lay the pieces out in random order in front of you.

At first your attempts to piece the parts together into the form of some animal may seem about hopeless; the pieces, nearly all different in shape and size, refuse to pieces you wish. After a little practice, however you will become astorpsisal at the remarkably clever way in which Acclonestes divided the rectangle.

For example, you will find that many of the points were fixed by bisecta g loses previously drawn

This provides a geometric division that gives you angles, sides, lines and corners



How to Make the Stomachion

You can cut out the fourteen pieces by tracing on cardboard or thin wood the pattern shown on the page opposits. Directions must be followed exactly



This baseball player and his restigenion were designed by Arthur L. Bmith

such as you will find in no other puzzle of the lond.

In designing your figure, you may use the pieces either right aide up or upside down—that is, turned over on their faces. Moreover, it is not necessary, according to Archimedes' own instructions, that the pieces be exactly in contact with each other. Large gaps between them, however, must be considered as actual gaps and taken into account when the lifelike character of the figure is judged.

THERE is only one hard and fast. I rule to the game. This is that every one of the fuurteen process must be used in your completed figure. In this very rule, you will find, lies much of the thrill and fascination of the game. For while it is comparatively easy to make a recognizable figure using a few selected paces, the real trick comes in fitting the last two or three pieces without ruining this figare. In fact, the discoverer of the game has declared that the struggle to place these last recalcitrant precent in enough to make "a wild man out of almost anyone."

How ingentously and artistically it can be done, though, is strikingly shown in the completed figures reproduced here.

As YOU grow more adept at the game, you will find it not only increasingly enjoyable, but highly valuable as well. It will stimulate your originality and resourcefulness, and train your eye in accurate perception of form and length. Any young person who plans to fit it miself for a career in which valual accuracy and padgment are important, such as that of art st or draftsman, will find it a wonderful and

I still quite recently, the Stomachion was known only by a few scattered refer-

ences to it in the surviving mathematical books of antiquity and in some of the Arabic mathematical works issued during the Dark Ages. The game was frequently referred to as the "Loculus of Archinucles," the word "loculus" meaning a small box or casket. Doubtless the fourteen pieces were kept organaly in shahow restangular boxes or Lange.

THRILLS

"I've been lost on the Polar Sea, but my experiences seem commonplace when I think of these hair-raising stories that Roosevelt, Bartlett and other famous explorers have told me"

says Fitzhugh Green

Yes, in my twenty-one years of naval service I have been pretty much all over the world and had a good many thrills. But I am beginning to believe that my most hair-running adventures full away short of the narrow escapes from death which my friends among explorers and travelers have confessed to me from time to time.

There was Selous, the great African game hunter. Once he

sand:

"I believe in the inherent courage and loyalty of the human

He had much on which to base his creed. He told of a black boy on the hast African coast. Labor pirates, shivers of the twentieth century, had stolen the boy a father and mother. Its alaerity with his knife the boy had alam one of the white men, a ounded another, and escaped.

BECAUSE such news carries fast in the jungle, the pirates could not afford to let the lad go unpunished. After much effort they caught him, Unnameable tortures, followed by debherate manning, was the program meant to frighten other natives who might resist.

My friend, the white hunter, came upon the acene just after the torturing and before the maining. He shot to kill and saved the black boy.

School. A year later the latter corbered a honess in brush. Rashly he closed the thicket. The honess sprang. A sore and awful death seemed for a split second to be the honter's fate. In that split second the black boy also sprang. He landed kneeling, holding his sharp spear upright under the flying body. The honess in pased herself on the spear. But before she died she tore his shoulder flesh and one eye from the boy

"It was nothing," and the boy when he was freed from the camp bospital two

Art Young, how and arrow expert, has told me some of his adventures with this frail weapon.

"At the last moment don't you wish sometimes that it were a gun?" I asked him.

He shrugged, "I did in the beginning,

He brought forth from somewhere a bone, the shoulder hone of a large hon. Impaled in the hard humerus was a steel arrow Lip.

"Try to budge it." he suggested I need my full strength but could not

dislodge the sliver of steel

'That's why I need not be worned " be explained. "Of course sometimes exeminstances that have nothing to do with my box are a little disqueting.

THERE was that afternoon in Alaska bear. My partner and I wanted a film showing the killing of one of those monsters without a game. Several came along at once. I picked out the biggest, a shaggy brute standing twelve feet in his stocking feet.

While the camera man cranked, I ensed up with a hundred feet of my prev. He looked hig as a full grown elephant in fact, he was it much smaller I was absolutely unwined save for my how and quiver of arrows.

"Just as I came within range, a second big grazily began to charge me from my right. It was a ticklish moment. In a sense luck saved me. I shot the big bear in front of one, wounded another near him. The latter ran. Seeing the wounded one flee took the heart out of the beast charging me. He turned and ran. Thus I had left a good film a dead K whak bear of imprecedented sure, and my life."

Speaking of bears remoids me of the experience my friend. Metoq, a Smith Sound Eskimo with whom I spent some weeks, once told me.

DURING a period of famine he and two other men had driver out on the Baffin Bay we as the February moon hoping to get some walrus for their gaunt dogs and starving women and babies. About ten in les off shore a high wars came up willout warming and began to break the heavy floes about. Metor, tells at simply

"We know the terrible danger. Many Eskinos have died this way. We turned and drove with all one strength toward the land. As my team was weakest. I came last. The drifting snow almost smothered me. Driving bandly, I dri not see a black lead obening ahead. The dogs.



When Commander Oreen hears his friends of the Raplarers Club in New York femous adventurers all tell their autounding tales, his own life orems commonplace. And Green himself has led un amazinally adventurous life. He is an Arrive exploiter of wide experience. He has alriged more than 1,000 miles up into the Polar See, been impresoned in the ice of the Far North and had numbers of other experiences not even hinted at in this article. Here he tells some of the the life he s not so sorry be has massed.

THERE'S no joy quite so great as that of cluding death by a close marger. To most people this joy is denied. Average life is commontance. It is the linky adventurer may be considered fortunate in two ways, he escapes death, and he has the thrill of the risk he took.

My own life has not been altogether colorless. In 19.11 was jost on the Polar Sea in a howling blizzard that lasted many days. During the Great War I fought in a man of war with the British Grand Fleet. In 1921, 180,000 pounds of smokeless powder blew up before my eyes at the Navai Proving Ground. An angry cougar once maided me in British Columbia.

I Never Had

sprang across. I nearly fell in, letting go the upstanders of my sledge just in time.

"The lead widened to twice a man's length before I could gather for a jump. I was too late. At once I knew I was drifting out into the sea on a big pun of ice. There could be no other fale but death, unless the Almighty Devil changed the wind.

"Worst of all, I found I was not alone on the ice pan. A big white bear had been caught there with me. But he made no

incree to attack.

"One small accident saved my life. I found that in our wild dash for land a snow knife had faden off one of the stelles. With it I built an igloo and crawled in. When the worst of the storm was over I came out. The bear was still there. And he was hungry now, as I could tell by his new interest in me.

"IN THE faint light I saw a sent had crawled up on one end of the floe. I was very cold. But I lay in the mow and crawled slowly toward it, unitating an other seal, and stabbed it to death

(This may sound immonal. But I have seen an Eskimo approach within a few feet of a seal by this method many times.)

"I fed most of the seal to the hear As a result be consed to be interested in use and slept."

For a month Meton drifted around on the ice pan, killing seals and feeding the bear as well as himself. As soon as his

A Never-to-Be-Forgotten Thrill

Coptain Robert A. Barrietz, knoting the most during of Arctic explorers, found his greatest thrill in a shipwrock. "Though strong as an or," trys Green, "I have seen Barriett's hand shake when he speaks of the wreck of the Corintoch" ment supply got low he had the sensation of seeing his big white shipmate licking his chops for a mouthful of Eskimo. But each time a scal turned up before it was too late.

Metoq's wife finished the story when the man's memory of her sofferings overcame him. "He worked for a long time with seal bones and bits of tendon," she explained. "Finally he fashioned a sort of harpoon with his kinfe as its tip. With this he killed the bear. Then the Aloughty Devit changed the direction of the wind and he drifted back to land two capes below the one on which we live."

I lunched once with President Roosevelt. He spoke of a nightourish incident that happened on his South American trip to the "River of Doubt

"The purgle was so thick." he said, "that we had to travel almost entirely by water. One morning we broke camp early to be on our way to an absolutely unexplored part of the river.

"We could hear rapids just around the next head. The native paddlers were apprehensive that there might be an unexpected waterfall aboad. One entered his cannot to investigate. Somehow he got adrift without his paddle defore we could stop him he was sailing down the river, yelling madly for us to throw him a line. Then he disappeared around the bend.

I RAN after the natives who had dashed along the above to save their tribesman. We came to a large rock which we mounted. To our horror we could see that just below us the stream dropped out of sight over a finds at least a lumified feet high. Personal on the very brink of this falls was the terror-stricked pative in his cance. Because he sat in the stern his small craft had grounded on a rock.

"The poor man dared not move nor shout for fear he would dislodge the canoe

and plunge to his death.

"For nearly an hour he sat there motionless as a statue. He must have died a thousand deaths during that time. Of course his friends yelled encouragement. They told him a rope was being brought But they warned him not to look around lest he move his boat and die.

"Trai after trai was made to float the rope's end down to the cance. Several times a commer carried the end out, but the current proved too swift and the

rescues nearly drowned

Finally one man managed to awim across well above the rapids. He took along a cod of rope to the end of which he attached a light stick. By skilful maneu vering he brought this stick floating alongside the man in the cause, who reached out to eatch hold of it.

"Just as all had feared, the first move dislodged the capoe, But the native kept his head. He whirled and grubbed the rope end attached to the stick. The next moment he was being haided ashore. He



His Bow and Arrow Saved Him

Art Young, famous bow and errow expert, told the author of an autounding adventure he had with an extraordinarily large Aleskon bear. After the fray, as Young outsplacently finishes his tale, "I had left a good film, a dead Kodish bear, and my life

was ill for three days from the nervous shock of his frightful experience."

Captain Robert Bartlett, of North Pole fame and here of the Korlak, had a sendar glumpse into the eyes of death. You wouldn't think Bob Bartlett had a nerve on his body. He is strong an an ox, but take a battleship turret close to the ground, and weight well over two I coursel pounds without an ounce of fat on his body. But I have seen his band shake when he speaks of the wreck of the Cornwards.

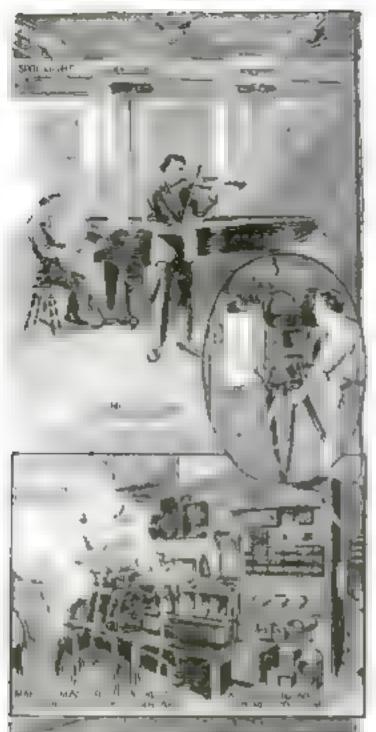
In the dead of winter Captain Bartlett's ship, the brig Corastade out of St. John, was wrecked on the south coast of Newfoundland near Devil's Ledge. It was just before dawn and during a blinzard High black chiffs line the shore at this point. Save for an occasional crevice, the heavy surf thundered against vertical rock walls that spraing out of the boiling sea.

"WEKNEW the vessel was doomed," the tells at norrowfully. "It looked as if we didn't have a sheed of a chance to save our own lives.

"We did the only thing we could. We hanched the last heat. The other two had been croshed. We tumbust in seeing nothing in the darkness, and expecting every manute to be thrown a to the my water.

"A hoge wave shot us landward. As it crestest and broke I prayed. I thought these were to be my last words. My prayer was answered. The boat was smashed but we were carried up into one of the narrow gashes that occur in the rocks only a few times in a mile.

"We struggled to our feet. But our fight had only just begun. We were soaked. The tide and waves were rising. Death by freez- (Continued on page 195)



How SHADOWS Talk from the Screen

Sight and Sound Are Kept in Step by Amazing Invention

By L. U. REAVIS

DESTREAD interest has been aroused remails by the first public len instructions of a mary clous reward transfer the problem of the problem of

Tasks Zyrbal task a core was a summer and found as a law of a core was branch as a law of a core was a law of the core was a store and a law of the core was a store and at the core was a store and a store and a store a core was a store and a store a core as a store a core and a store a core as a store a core as a store a core as a store a core a c

If the print of texterning the control of the print of the section show and the section show are made to the section of the se

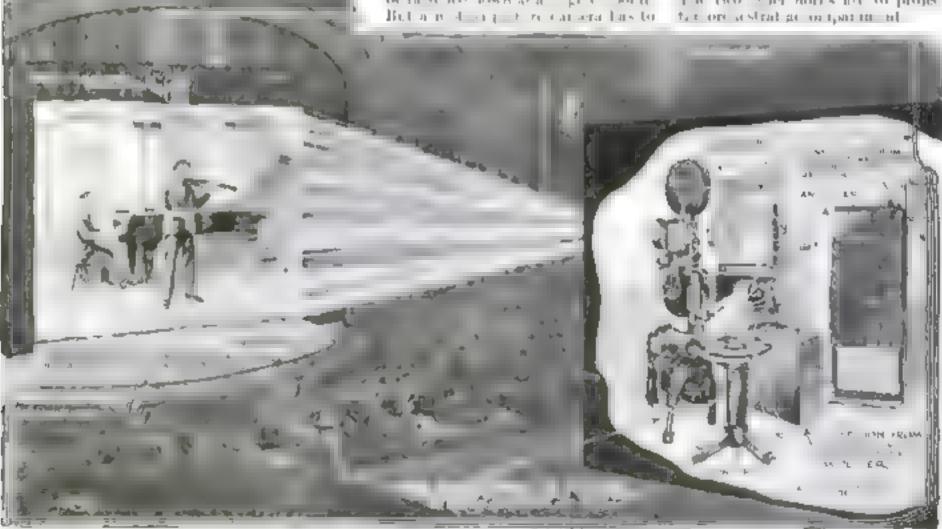
the taking the postures I show to be recorded on a k I some raise the disk will be brongered to result over a constitution of the result over a constitution of the result over a large constitution of the result of the result over a large constitution of the result of the result over a large constitution of the result o

be moved about constantly, so two separate motors have to be used. The two motors are electrically interlacked as that they rear a resent

As the seneral records the partures for sends are present in the are reserved to the first and the process of the first and process of the first and the areas of the first and the process of the first and the groupe of the mainter record.

FINALLY, when you see the property for the transfer, the property for the action of search disk are referenced for the first of pressions at the disk are to be transfered as power to the action of the pressions at the disk are to be a power to the action of the pressions.

In the thinglet class the arguer and in the specialization pit between the street are as the property of the treets are possible come from the preferes. The two there have a maintained



How the New Talking Movies Are Made

The top picture about the method of taking the new movies at the studio the camera bouth being soundproof to keep the cheking of the camera from being remeded with the other sounds. Note the microphone on the colony. Below this is shown the making of the partier sound.

second from which other similar disks will be made. This disk is larger than the usual master phonograph disk. Pinally our arrier shows how the parture and sounds are synchronized so that you hear the violits sounds apparently exercing directly from the player on the screen

A Sequel to "The Cop Always Wins"

A Symposium on Roadside Justice by Our Readers, Including Motorists, Magistrates, Policemen and Clergymen, with Comments

YN OUR September issue Edgar C. Wheeler revealed some startling facts about the chaotic conditions resulting from conflicting traffic laws and regmations, and about the trickeries of officarl inglaway new -- tanscrupusois squares and constaines who, under the closic of legal initionity, prey upon the much ring Lot, bath

Concerling that policemen and laws are necessary to safeguard the highways and that most officers are rosest and constrentions, Mr. Wheeler contended that "right or wrong, the copalways wins." We wanted to find out whether or not our readers agreed with Mr. Wheeler, so we invited them to tell us of their experiences

Hondreds from all metions of the eountry responded. Most of them related apcidents of unjust roadside justice. They commended the efforts now being made to clear the roads of paseropulous efficers; and to bring some sort of factorial uniformity and order out of our tangled traffic regulations. Others however. while admitting the need of greater uniformaty in motor laws insisted that stricter has enforcement to curb thoughtless and reckless drivers is more important at the present noment than curbing the practices of a comparatively few officials who may

eventep their authority. In support of their contention they pointed to the appalling increase in the automotide death.

toll in the United States.

Quite naturally in large proportion of the letters were from motorists who had been arrested for speeching and whose word in court had been pitted against that of the arresting officer. In almost every case the motorist paid.

THERE were a few, however, who challenged the statement that "the cop always wins." For example, B. P. Humphreys, of Rebance, South Dakota. related how he actually got the heat of the argument before the judge. Mr. Humphreys was arrested on a charge of draving forty miles an hour just after leaving the salesroom with a new Ford car. He tells at this way:

"I asked the judge to excuse me for a moment to step over to the place where I had purchased the car Returning with the proprietor and a mechanic, both swore that owing to the fact that mine was a new car, it would have been imposmole to get more than twenty-five miles an hour out of it. When the judge heard that, he decided I was innovent and toki me I was released. *

Other motorests found that the magistrates before whom they were summoned

were not so willing to listen to reason. For instance, the Rev. Charles F. Zainmach, paster of the Immanuel Baptist Church at Example Pl. writes of a justice of the peace who would not permit him even to defend himself. Mr. Zammuch was approaching a small town in Pennsylvania when he was arrested on a charge of "reckless driving." He was proceeding with unusual caution be says, because he had been warned previously

Where They All Agree

THESE letters are typical of the views expressed by bundreds of our readers -motorous, image-trates and police offi-

Some of them, you will see, thangree with the opinion that "right or wrong, the cop always wans." Others, including justices of the peace and police officials. are inclined to blame the motoerng public.

On one point, however all of the letters seem to agree, eather hy direct statement or amplication. That is the need for natroposide uniform laws which will easable an automobile driver to follow in aniety has local traffic code anywhere,

that that town "needed the money." and was collecting from motorists. his experience in const. he writes

"I protested but was not betened to. I demanded that my wife and daughter, who were riding with me, be hourd, but was told that I could appeal to the courts. I was fined \$10 and costs, \$1.75. I asked, What for that received no intofaction. Meanwhile other victims were brought us, all tourists from other states. All were fined on trumped-up charges. At the office of the Motor Club in Cleveland. Ohio. I was told later that dozens of affeliavits had been filled against these same officers, charging conspiracy to extort money, but the graft null was runaing merndy on-

Edward K. Whitcomb. of Laucaster. N. II as convinced that traffic officers as a rule show partiality to motorists of their own state, and mostly pick outsiders as their victims. Of his experience he

"NOT long ago I was reduce along a New Hampshire road about forty five miles an hour when a con stupped me. All he and was, 'Thirty miles on hour is fast enough,' and let me go. Then he speeded up and nabbed the car ahead. which I had been following! Another time, when I was on one of the Massa-

chosetts turnpikes. I was keeping in line with other cars going thirty-five to forty miles, when a mator cop singled me out and arrested me for speeding. Lexplanted that I was only keeping in line with the others, but it did no good.

Mr. Wheeler's article exposed a mimher of the different kinds of "traps," some of them highly ingension, in which country constables catch unwary trav-A number of our readers have

added to the lot. George Mandsley, of Cleveland, Ohio, for example, deacribes how he fell into an unusual Diffell

Y WAS driving along a country I read when I came to a spot where the pavement was being fixed on the right side of the road. Naturnaly. I turned to the left of the road to go around it. Instantly a truffic cop jumped out of the biphes and took me to a justice of the peace, who fined me five dolars and costs for driving on the wrong side.' There was nothing clse to do not may the

Still another sort of trap proved costly to Patrick Brady, of Kimball,

S. Dakota, who printes, The suburbs of a certain Sorth

Dakota town are very felly and the speed cop in this town makes capital of the fact. He conceans lamself at the base of some steep lift. Devent, naturally, will speed up a little in order to make the hill without shifting gears. That is Mr. Cop's cue. He bounces out and stalks his prey. I know whereof I speak, for I happen to be one who had been bitten. "

DOZENS of letters tell of mendeate in which officers have made a farce of the lowar A St. Loois motorost, J. C. McEwen, relates an astonishing montent. in which a guilty speeder made his escape, an improvent derive was accepted and fined in his stead, and a third motorist eventually paid the fine. The facts in this case which came to Mr. McEwen's notice one day recently during proceedings. in a Missouri constroom, he tells in his letter as fodows

"One motorist who had been haled into court told the judge that he was driving along the highway when a high powered car passed him doing about sexty-five miles an hour. He protested that as be pulled to one side and stopped to get out of the speeder a way, a motorcycle officer came up and arrested lum for speeding. The officer was out of gas and could not eatch the high-powered car, so be picked on the nearest driver. The judge fixed the manceat man

twenty-five dollars and the court costs. "It so happened that the convicted driver had a friend with a 'pull,' and the judge later decided to let him off. The record of his conviction, however, was already on the books, so here is the way the court worked st:

"In about ten minutes another victim was brought in and fined twenty-five dollars and costs. His name was not put on the records, and his money went to pay the fine of the man with a 'pull' "

That the motoring public itself, rather than officers or courts, is to blame for making a farce of traffic laws is the contention of several renders. By thoughtless disregard for others on the road, by defiance of existing speed laws, and by the nureasonable desire always to "get ahead of the other fellow," the average motor-1st of today, it is charged, brings upon himself seemingly unjust arrests on trivial charges.

N THESE letters, stating the other A side of the story, there is some food for thought for every car owner, however unjust he may consider his treatment at the hands of the authorities. For instance, Vinton A. Holbrook, an attorney of Los Angeles, Calif., writes that when he strictly observes speed regulations and

carefully avoids taking the sughtest chance, other motoracts regard him as a pest. In 30,000 miles of the most careful sort of driving, he tests us, he never once has been arrested, although warned occasionally of slight infractions of the rules.

I should my that not one driver in eight or ten obeys toe roles with anything approaching exactitude, he says. "When I go fifteen miles in 🛎 village street, they go around use constantly and even bonk for me not to obstruct traffic.

"I realise the ensuperation of a careful driver who is treated unjurtly, and I know such things happen occasionmly; but from my expenence I know that much of this trouble, expense, and ja long could be avoided if drivers would be decently careful."

And a New York City motorot, William H. Strahan, goes so far as to predict that the automobile will pass from being a machine of convenience and economy to one of costly destruction unless strenuous efforts are made to control its

NE means of control," he suggests, "should be the perfection of a mechanism to prevent any car, except such emergency machines as ambulances and fire engines. from traveling at a speed greater than twenty-five mules an hour. What we need far more than the new improvements in comfort, appearance, and speed are improved safety devices and better systems of braking and control."

Other letters, expressing the point of view of the magistrate and officer of the law, give some idea of how the passing motorest appears to the man at the vilage crossrowis.

Here is one from A. Roy Perkins, a justice of the peace in the village of Mayvitle, N Y., who maintains that the draver who is most thoughtless of others as he hurnes on his way is the one who protests most loudly when he is arrested:

"If some motorists would take their manners with them when they go for a trip," he writes, "they would get along much better, but most of them feel they have a perfect right to go through a village street past intersections at forty miles an hour. If anything is said about it, they are hadly insulted and misused.

"FHERE are many motorists who in their home towns are no doubt very respected estment, but who, when passing along country roads, do not heutate to go into the farmer's field and help themselves to whatever they can find. If they run over a fowl they pick it up and carry it on, if they think no one is looking. I have found that these people are the ones who muse the greatest howls when caught, rather than those who may be forced to pay a fine for some minor

offense which perhaps ought to have been overlooked "

And this from R. L. Bonner, chief of

police in Kelso, Washington

"For more than a year I have been the chief of police of this city of nearly 10,000 people. On an average we arrest about twenty five a month for speeding. Never yet have we stopped anyone for less than thirty miles an hour (Washington has a thirty-mile limit on the highways and twenty miles in all towns), except in possibly half a dosen cases of passing by a achoolhouse when children were crossing the street.

TT MAKES no difference to us whether I we arrest one or a thousand; we get bothing out of it. We never hide on anyone. We stop many drivers each day and tell them to 'hold it down,' but in spite of that the motorists will insist that we pick on them.

Don't forget that the motorist is not bashi it about knockrig anywhere from five to twenty miles from his speed, and saying the arresting officer picked lum out of several thousand cars to hang a speed-

ung charge on him!"

H. S. Westbrook, justice of the peace in the vallage of Dunbar, Nebraska, writes that some of the automobile tour-

ista are "our worst offenders and lawbreakers '.

"They seem to think their minutes are so precious, and have no respect for our speed heart agast of any thought or care for our children. They should at least drive carefully. The fault is not at all with officers of the law.

DDLY enough, in the lettera from some of our readers there appears considerable evidence supporting the indictmegatithat often the motorist who grumbles is the one most at fault. For example, one of the writers, an automobile mechame, protests at his arrest for traveling thirty miles an hour while testing a repaired machine on a public thoroughfare. Another complains of being aubbed for pushing past a street car while it was unloading passengers, declaring the traffic aignals were with him. A third thinks it unjust that he should get a tacket for parking his car in the middle of the street, contrary to town ordinances. Still another protests his arrest for backing down a thoroughfare against traffic.

All the letters that have come to POPULAR SCIENCE MONYRLY seem to point to at least one general conclusion regarding the traffic situation --- that the thing most needed for the safeguarding of the nation's highways and the protection of the motoring public is some kind of national uniformity of traffic laws, together with more intelligence in the enforcement of the laws, and in the driving of automobiles.

What the Birdman Sees



Townsend Studies

PHOTOGRAPHER on an airplane caught this striking view A of the submarine O-3, trailing graceful plumes through the waters of Long Island Sound during revent moneyers of the Navy off Block Island. Note the needle-like narrowness toward the stern, to afford the least possible resistance in making speed

Is the Earth's Face Changing?

Radio Net Tests Theory That Continents Are Drifting

O had the past lazarre value of the or ever not a red by a new receiver at a red by a new receiver or reconstantians reversagement of the constantians reversagement.

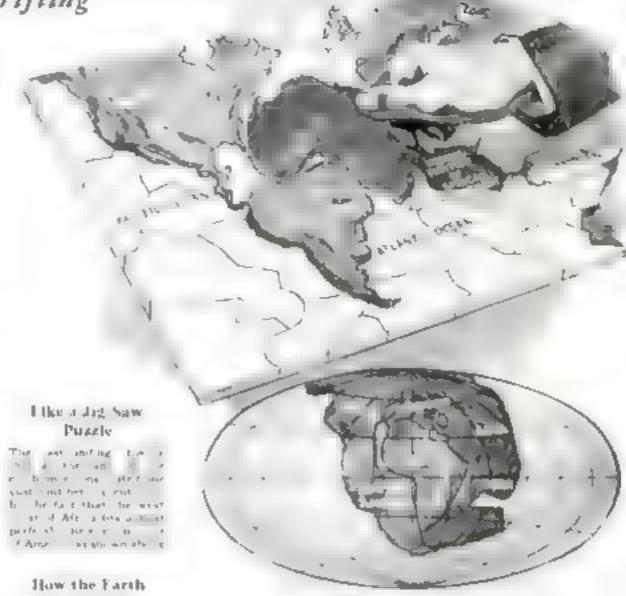
The pass from the form of A feet Western of the Western of Come Arabe at the Western of Come Arabe at the attraction of the and property of the theory of the arabe we know; that they are still reforming and perceptible restricts we want and enterestible restricts a second ward and enterest that he reports should be a few or that he reports a few or that he reports a few or that he reports a few or the reports and the reports a few or that he reports a few or that he

these values taken at the rate is those at the event intervals will enter properly the strates to find the event tree for a term and other transfers in a second of the event and other transfers in a second of the event and other transfers in a second of the event and other transfers in a second of the event and other transfers are a second of the event and the eve

The resemble selection was the Wego per Lars secretaried to or agree to the Topolish best of the present during a rate of the matter than to be a passed of the transfer of the results about the second of the control of the periods of the periods.

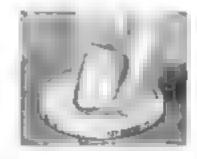
Process Weggers save traiting at sure to a discussion and a more continuous sure as a sure of the sure

not be a comment protection and appearing to the protection of the



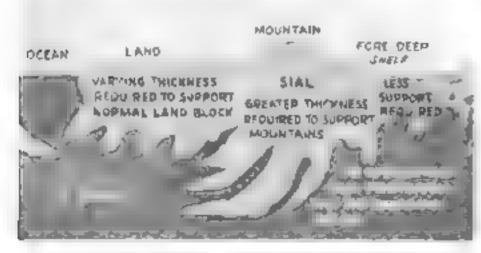
How the Farth Spread Out

The draw rags of the right at a who e through the right is a history of the right at the right a







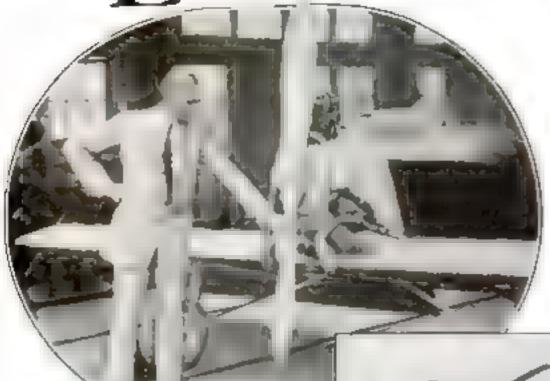


How the continents might have drifted from their original station on the earth and how they may still be drifting is made plant by these sectional drawings, which picture the outer layers of the corts as compared



of meterials of varying plasticity, one floating on the other. Due to the attractive force of the sun and moun and to the shrukage of the core of the carth, the outermost layer alters its shape, breaks off, and drifts away

atest Planes Herald New



For the Man of Average Sicana

Nonry Ford, inspecting the sewest Ford product -one of the smallest single senters ever built. When completed, it will embody several novel features in hi the meds of the men of nverner meens wishing to dy his own plans

FEW weeks upo Louis Blerrot, who in 1909 was the first man in the world to fly aeross the English Channel, made his second crossing to England by a rplane. At the end of the trip he was asked why he had not always Varied England by a r

"Because," he replied, "until two years ago I considered flying from Paris to

London too hazardons.

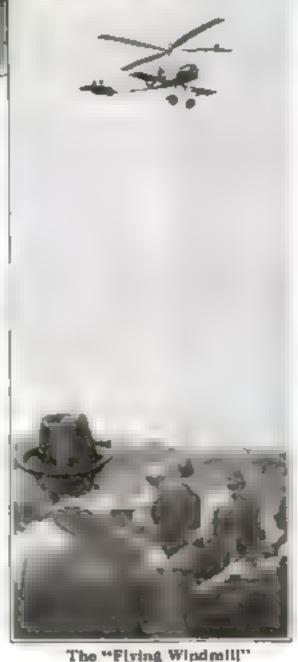
It was a surprising statement to come from a man who had been one of the world's proncers in avention. Let t echoed truthfully the feeling a majority of an have had about going up in flying machines. We have tasked much about the safety of amplanes. In words melfigures we have compared them favorably with automobiles and an Iway trains, and we have been non-red repeatedly that before long we should be a de to drive our own "sky flavyers from our back yards and roof tops

let wherever we have had the chance to take our turn in the air, many of as have balked. What if a wing should break or the engine stop? Like Bleriot. we and our families, have said. "Too

Pinks.

D1"I' now there are many untuistakable D signs that the world is guinting confidence in its wings. We are stepping into a new day in aviation. Yesterday a fasconating art, flying today becomes an exact science, as exact as bridge building. The amplane is fast becoming a conveyance that any of us may own and drive as we now drive our motor cars.

Two years have made a big difference. Witness the air mail, the commercial air lines, the flight to the Pole. Today events in the realm of aviation are tumbling along at such a pace that we can almost



The outogiro, whose forthcoming demonstrations in America are being awaited with kres interest in flight at Hendon England. The "windmill wangs are its unfety feature If the engine stalls in mid-air, the plane will descend slowly like a parachate, buoyed up by the rotating wings that can be seen above

imagine ourselves spending next summer's vacation touring the air roads. Consider

As this is written there is consing to America the amazing "autogiro" which, judging from recent tests by the British Air Ministry, represents much in the way of a foolproof, noncrashable flying mathine. At this writing, too, airmen are preparing to hop across the Atlantic from New York to France in a magnificent triple-engined monoplane. Mussolim, to create "air consciousness" to Italy, is uffering free flights in government planes to all Italiana.

With Inventors Producing

Foolproof, Nonsmashable

Aircraft, Experts Say

We'll All Fly Own

Machines Soon

And there is more. President Coolidge, for instance, has just approved a program of cross-country surways for passengers, must and express. Edsel Ford has informed the President that his company is ready to produce flying machines in quantity. Henry Ford recently demonstrated has new "flying flyver" which is to be brought within the reach of every man r pocketbook. I myemitien have opened schools and laboratories for mtensove study of flying. Mr. born of dollars have been made available to promote safety in the air

WE ARE moving fast. Still there re-most knotly problems, which must be solved before our dreams of the flying motor car can come true. We all want to fly, but how are we going to do it?

Late in the manner I was voiting a beach on the Atlantic senboard when a gypay flier in a shring new seapline swooped down to the water and taxied into shore. In the crowd which quickly gathered as he made his hid for passengers was a little gray horsel wasnan in a bathing mut. She listened to him for a few moments and then burrying up the beach to ber batabasise, the returned with a five-dollar bill, her fare. Donning the goggles and an old yellow shaker which the priot offered, the climbed into the cockpit, and away they went.

After a brief flight as the senplane nosed again into the shore, the face of the

bttle woman was beaming.

"If I could own a marking like that I'd be happy " she exclaimed "I drive I could ever learn to fly? But then, I suppose surplanes cost so much that folks like me couldn't ever hope to buy one. And besides, if I had one, where could I keep it and fly it from?

N HER enthususm she was simply expressing the problems which aeronautical engineers and manufacturing experts are tackling, and solving. First, there is the need of an airplane so automatically stable that the novice can bandle it safely Second, the cost must be lowered, by the same sort of standardisation and quantity production that brought automobiles within the reach of other than the wealthy. And finally, some way must be found to permit airplanes to rise quickly from a

Era of Safety

By EDGAR C. WHEELER

very small space, such as a readway, yard, or roof, and to land in the same limited area.

Possible solutions to the first and last of these problems may be conbudied in the latest model of the strange autoging, the invention of the young Spanish on gueer Juan de la Cierva. Various steus in the perfection of thes revolutionary from gonaction and demethod of operation have been leserolest from time to trop a Port han be and a Monthley. In resent tests in Engineed the safety and easy of control of the "Ilving winduck up it has been called were demonstrated we effectively as to lead to product up that it would make the trents of fiving actions reality. Now it is to be de nonstrates, in America

THOSE who have wit sessed its performagers let us that eve of the pilot removes his hands from the controls, the autogree will right itself automatically in the air. If the engine stalls, at any height, it will descend slowly, like a parachute, without danger of a crash. Moreover, in making a landing, it will rome down pluosit vertically, and halt within a few parts of the spot where it first touches the group of Chile a small plot of ground is recovered for safe landing.

Yet while the autogro apparently has solved the difficult problem of safe vertical amount from any largest it still has not mastered vertical assent. To attain flying speed and lift the machine from the ground, the windingly wags must reach a speed of about 129 revolutions a minute, and this requires a run of about 120 yards along the ground. Circum believes that by applying mechanical power to the windingly at the start, the machine can be made to use vertically like a helicopter.

"The solution of this problem," he says, "constitutes the next stage of experiment with the autogen, and if we succeed the day of the safe fiving automobile will have definitely acrossed."

He predicts that eventually an autogro of twenty-five to fifty horsepower exertog one or two persons, if manufactured in large quantities, could be sold for about \$2.000

Two other ingentous methods of lessen-

A Safe Landered

I provide the Sam resolve

I make a substance of the solve

I make a substance of

ing the danger of stalling also come from hinghand. One is known as the Handle's bage S of a device to enable the pilot, when his machine stalls, to use his controls sufficiently to present a nose dive to the ground. The other is a new form of a rplane almost as strange in appearance as the autogrou.

This may one is the Pterodactyl or talless arplane designed by Captain to T. R. Hill and particed in a recent issue of Postark Science Montaly It is named after the curious prelistoric roptiles (flying dragons) whose foisils have been found in the rocks, and it resembles these extinct beasts in that its two wags instead of extending straight outward from the body of the ship, slant by sward and end or pointed thes.

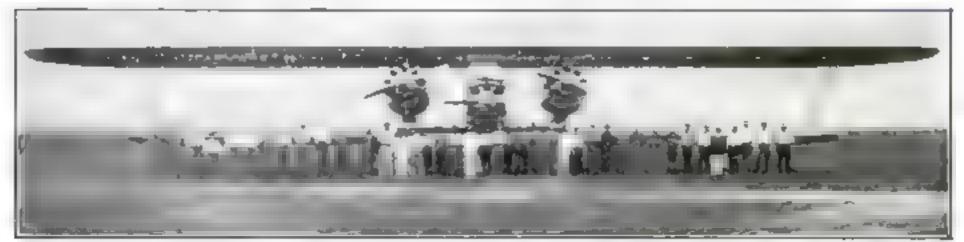
The mass he has no far or sudder. Instead there are movable flaps at the tips of the wings which act in controls. The uniteral arrangement as butsoices the much ne that when it loses forward motion it does not drop its noise, go into a span, or get out of control. The backward sweep of the wings con percentes for the absence of a tail. Altoough the plane, when stailed, sinks to earth, it kieps on an even

keel with the pilot in full control.

Still another amazing new safety device is the carious parachate acplane recently demonstrated in Los Angeles by tari Oclae formersy a naval air pilot. It is the evention of Harry B. Doncett, chief aviation much just a mate, 1.8 N., stationed at the Naval Air Base at North Island, San Diego.

SO CONFIDENT was Order in the success of the device that he risked his life to prove its value in making the air safe. With a parachute fifty feet in diameter folded on the top of his plane, he ascended to an altitude of 2500 feet. There, in sight of Army and Navy Air Service officers, he hosened the parachute and let the machine fall. Supported by the immense uniber la, the plane dropped slowly and steading, finally. (Continued on page 14-1)

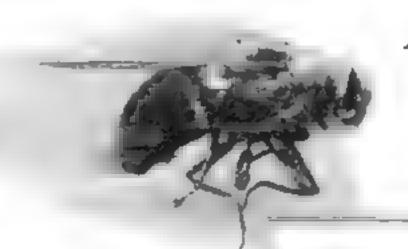
Most Magnificent Product of Aeronautical Genius Before Its Tragic Wreck



Gunt Sikorsky plane, the S-35, bunt for the New York Parm hop of Capt. Rene Fonck, French see. The photo shows the great wing spread

101 feet) with men lined up for comparison. The plane was equipped with three engines to insure an adequate reserve of power for all contingeness.

The FASTEST Living Thing



A Strange Fly from Which We May Learn How to Increase Our Airplanes' Speed

By EDWIN KETCHUM

CEPHENONYM

OT lang ago an American catamoke gist, Dr. Charles H. T. Townsend. was standing beside a stream at the head of a deep canyon in Brazil. Before his vision there suddenly flashed a streak of color. A blue of orange, it was gone in an instant.

That belliant flash, as he recognized at once, was the passage of the swiftest thing on earth—a strange fly no larger than a bumblebee, yet an wonderfully speedy that no specimen of it has ever been captured by man while it was in flight. It is called the Caphenomyia, or deer but-fly. and is a native of North and South Amersen and parts of Europe. It can travel 815 miles an hour, nearly fourteen unles a namite, or 400 yards a second, almost half us fast as the hallet from an army rifle!

"If men cound only learn how to fly like that," speculated Dr. Townsend, "we rould by aroung the world in seventeen hours. Leaving New York at four a.m. we could have breakfast over Reno. titlinabove Peking, Iea al Constantinopte, the per at Madrid, and arrive it New York at rine p. m. in time for the opera!

"Here," he concluded, "the facts are already written in maset economy. Why

emn't we copy them?

Why not, indeed? Dr. Townsend voiced his suggestion to the world, and it at once aroused engineers and scientists to a closer. study of the fleetest thong that travels on wongs, in the hope of increasing the speed of warged nuchraes.

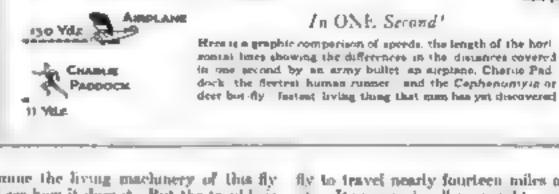
Man learned to dy from copying nature a thera. I gor Sakorsky, designer of the magnificent biplane in which, as this was written, the French ace, René Fonck planned a nonstop flight from America to

France, says that he fashioned the gunt markage on the lines of the albatross. IN SPEED, however, man-made ma-comes have outdistanced the birds. Now,

that other mostel nature offers - the strange fly which flies three times no fast as the U/S. Navy plane which recently flew at the

rate of 130 yards a second.

The big problem, aeronautical engineers tell us, is to reduce the bulk and weight of the place while increasing the strength and elasticity of its materials. Apparently the Cephenomyna has solved the problem, and it would seem a simple matter to



000 Yds

examine the living machinery of this fivand see how it does it. But the trouble is to capture them for study specimens in numerins were taken while the thes were surming themselves or white they were numb in cold weather, or were raised from larvac.

400 Yds

The most mysterious thing about it is the source of its tremendous power. For the little creature never eats once it beg as to fiv, vet it can generate a speed that secons fanciful and maintain it for long periods.

What is the answer? Does it reach full growth from the larvae stage with a reserve of power which lasts until the cold weather kills it? If so, it possesses the most remarkable storage battery in the world. The fly is known to spend long periods on rocks in high, clear altitudes, exposed to the powerful ultra-violet rays of the nummer sun. Is it possible, as scientists suggest, that the signs cays recharge that amazing storage buttery?

Engineers might learn something from the lubricating system which enables this

fly to travel nearly fourteen miles a minate. Its wings, in all propability, vibrate several thousand times a second. Compure this with one of our flying machines, which does well if its propeller can make 2 000 revolutions a monate

ARMY RYLE

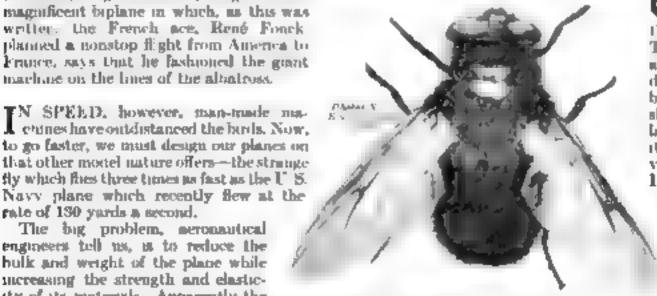
Or take the matter of chumnitum wind resistance. We noul doubt the Cephenoward how mastered this secret also. Procably the fact that it is covered with tiny hars resculsing funt may have much to

The wonderful design of the deer botfly may be imagined from what is already known of other lands of thes. For example, the wang pruscles of the ordinacy blowfly are a quarter of the weight of the entire body. In a more notable flier, the I olucella Obera, which is often seen hover oug in the shade of trees, the wang muscles weigh forty-eight percent of the total. While accurate figures on the wing nuiseles of the deer but-fly are not available, entomologists may it wal not be surprising if they are axly percent of the fly's weight.

O'E of the strangest things about the Cephenomyia is its breeding place in the nostrils of deer, elk, and antelope. The female fly awoops in a diray circle about the head of the deer, at intervals darling into the nostril, not alighting, but mutantly turning back. Each time she deposits a drop of fluid with living larvae. The deer sneeses, strikes out with its feet, and rubs its nose on its fore legs. vanily trying to dislodge the parasites. In the scuffle, the fly may be driven to

> the ground repeatedly by the ancesing of the deer, but quickly recovers itself, and with a loud burn wings off to attack other deer in the herd

From larvae taken from the heads of animals slain by hunters, accentasts hope to increase the supply of specimena of the fly, and through them reveal new secrets of speed,



Scientists estimate that the wings of the Confeccicry is vibrate several thousand times a second, but thus far have not found its source of power



Wind Reports for Aviators

U. E. Bignal Corps observer about 46 send up a pilet balloon to ascertain wind conditions. When hunched, he telephones its position at minute attervals to a recorder who is located in a near by station, and who in turn plots the observations as they are received.

BILL STILES was something more than the propertor of a ranch on the Cheyenne River flats with his brand on nearly 3,000 Herefords. He was the local weather prophet.

On the first cold day of autumn one of the hands, with a wink at the others, would announce sulemnly that it looked like a hard winter. And the "old man was almost sure to reply: "Well, it's about time I found out. I think I'll shoot myself a coltonial."

If there were may violars, he would take them up a draw to help scare up a rabbit. I went along with him one blenk October morning and within fifteen in notes we had our binny. St les examined its writer coat closely and announced with brighty.

"Yes seee it's going to be a tough one long and cold. See the thickness of the short bairs? Well, that's nature's proof "

That afternoon he rode twelve miles to the nearest ranch and bought sixty tons of hay to add to his great stacks for winter feeding.

We had about four feet of mow and some good blustards that writer. Spring dain't arrive until the moddle of April The hay was gone and the stock was skin and bones. The macher who add the hay last about fifty cows and "cossed" his lack, the weather and Bill Stries. The following fall he was around to ask Bill what kind of a winter it was going to be.

EVERY community—city as well as rural—has its weather prophet—And these oracles never have been as active as they are today, probably because we know more about the weather than we ever did. Right now the widest attention has been attracted by the prediction of a Chicago amateur that 1927—I've 1816, will be without any summer—He is supported by an "ocean meteorologist," who asserts there will be so many rold spells in the middle of 1927 that crops will be spoiled, causing a loss of hundreds of

Will 1927 Be A Year Without a Summer?

Weather prophets say it will, and tell why new discoveries about sun may make such forecasting possible

By PAUL A. WILLIAMS

radious of dollars. Even II II Clayton, noted meteorologist and former official weather forcester for the Argentine Republic, basing his prediction on the sun's radiation says. There is good reason to believe the summer of 1927 will be a senson of extreme cold."

More recently 2 m of science have taken a keener interest in the weather. They are trying to tust out if it reads can be accurately forecast a season in advance. With this objective, expeditions have been sent to the far corners of the earth to study the sun, winds and occan currents. At Washington, data is being collected from all over the world and comparisons made to learn what influence weather in one area has upon the weather months later in another area thousands of tudes distant

WHILE up to now the Weather Bureau at Washington has taken no active part in these efforts to find a more scientific basis for long-range weather forecasting, it is watching with interest the progress of the experiments.

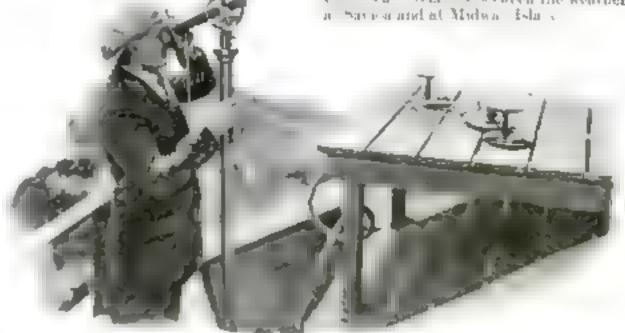
Molaous formerly deed of starvation in India when rasis called "monsoons failed to come. The Indian weather service found that monsoons are caused by winds carrying moisture from the seaThese words, when they reach the mountains in Northwest India, are pushed upward causing the moisture in them to condense into clouds and fall in the form of rain.

Studying the elements which act apon these winds, the Indian weather authorstics gathered sufficient serie tric data to make forecasts—three invotes it advance

whether there would be measons and crops. These forecasts have been justified in nine of sixteen years, from 1909 to 1924, and the Indian bureau is learning more about measons each season.

Till Indian burea i also discovered the pressure was high and line weather for in Northwest India from September to November at was sure to be low and the weather storing in Samoa from Discovered to February. This was forged one of the disconnected times as a wild weather claim.

One kind of weather in a certain area is definitely associated with a nether kind of weather on a ready the same time as another area. If the weather is for at Midway Island in the Pacific the temperature is islandy above narrowly 51 Louis, 5,000 more away. We already know three menths in advance what spring will be like in Samon, also in the Pacific, and forecasters are analyzing records to see if the same relative tween the weather a particular and at Midway island.



Checking Up on Old Sol.

The suppressed variations in soler radiation are now regarded as a possible basis, for predicting weather stances about. Measurement of the rays is made with a pyrheliometer, as shown above



Tree Rings Tell the Weather

We can find out pretty exactly what weather conditions prevalid a certain year contactes upo by anamining the annular rings of a tree. Secret ats and weather experts are now studying these rings to brain new facts about sectors and tumpersture.

Fair weather in Alaska is almost always associated with low temperature in the United States as far south as Memphis, Virtually all our American weather comes form Maska, or rather the Bering Sea, and it is regain is sometimes referred to as the "mother spot". Storms generated there by the clashings of warm and cold currents of air and water sweep down the Pacific coast, enter the country around Washington State and travel eastward at the rate of 600 or 700 miles a day. This weather is modified by such conditions as it meets in its journey.

The Berrig Sea is under the close surveillance of weather scouts who hope eventually to predict the major disturbances originating there a considerable period in advance. At present, the best they can do is chart these storms with their matruments and trace their courses. Weather may be said to be manufactured. at the equator and in the Arche regions. The sun, shining almost directly on the requator, heats enormous masses of air which rise and move toward the North and South Poles. They come in contact with equal masses of cold air, they intermingle, mill around, and storms are erented.

ME hig weather factories, then, are in the Aretic and Antarctic, and the Univereity of Michigan has sent an expedition to Greenland to establish four observation stations for at least a year There is a difference of several days between the origin of hurricanes on the Greenland ice cap and their appearance in Western Europe. The observers, by tneams of radio, hope to give warning of these storms one or more days in advance and give trans-Atlantic shipping time to avoid them or prepare for them. The radio station will be sunk deep into the spow and anchored to prevent it from heing blown away by the terrific winds, which often attain a velocity of 100 miles

The equatorial region is the power house for making wind currents in both hemispheres. The heated air, miles high, flows north and south and descends about latitude 55" north and south, forming the southwesterly variables in the north and the "brave west winds" in the southwest. Winds in the north are more rapiable because the greater amount of

land in the northern beamsphere—interferes with the regular currents.—Differences in temperature of the land and sea — a u a — local storms, the sir being affected by the reflection—of—beat from the land

The northeast and southeast it rin die winds are caused by the constant influx of cool air at lower levels to keep up the supply at the equator where it is always rising. On the horders of the equatorial zone develop the tropical burn-

canes, generally in a westerly direction, and typhonus in the Chica Seas.

The meteorologist Bjerknes assertathat the mass of cold air in the polar regions and the masses of bot air in the trusscal regions are reparated by a surface of contonaty which he calls the "Polar Front It is at the P dar knowt that most storms develop. The warm air pushes the cold air in front of it, and at the same time rases over the cold air. The cold air behand the warm sector pushes underneath the warm air, which is gradually reduced. The Polar Pront is wavy and irregular. It advances and recedes with tongues of air which, in their progress from west to raid, cut off areas of warm moist air Thus a twist is established and soon a rutary motion begins.

PROFESSOR Alexander George Mc-Adie of Harvard mys that when an area of high pressure stagnates over Labradoc, the storm will then move southeast slowly and will be accompanied by forty or more hours of man. If there is snow on the ground, or it is souked by two, there will be flowls. Thus a few days' warming will be received.

In the old days forecasters were not restrained by their lack of information. They used to close their eyes and give the public what it wanted—a forecast. Yet some of them had remarkable luck. One of them because famous throughout Europe and reaped a fortune through the sale of his almanacs. His name was Patrick Murphy. In his almanac for 1838 he predicted

"Jan. 20-Fair. Probably lowest de-

That day was the coldest England had had for many generations. The River Thames froze and a fair was held on it. People flocked to buy Murphy's Mimanac and there were more than lifts entrance printed. Murphy netted about £3 (5.5), which was a considerable sum in those times, sufficient to keep him well for many years. The season became known as "Murphy's Winter" and his subsequent almanacs were widely read. Most all of his preshetious were clastic, conched in phrases subject to almost any interpretation, but his one bull's-eye made him the greatest of all the amateurs.

In the latter part of the nuncteenth century, Rudolph Falb, a German, made

a reputation by classifying as "critical days" those dates when the earth, moon and sun occupied certain relative positions. They were not "critical days," but the expression caught popular fancy and Falb became right.

While winds are caused by differences. in temperature, the temperature itself is influenced partly by the movement in oceans. And, in turn, thus movement is governed variously. Currents in the seas. are caused by wind, the friction of neighbotug currents, differences in pressure resalting from evaporation of sea water, rainfall, and changes in specific gravity And currents are modified somewhat by the deflecting force due to the earth a retaines, and by the internal friction of water. Within currents, cold water from the deeps a constantly welling up to the surface, affecting the temperature of the air and giving to changing weather.

THUS heated air and changing ocean currents are continually influencing one another, and amentisticate now studying the temperature and movements of the surface water of the sea in the belief that the data will materially aid the weather man in making long-distance forecasts.

For the same purpose, other scientists are measuring solar radiation—the heat thrown off by the sun.

These scientists, led by Dr. Charles G. Abbott of the Smithsonian Institution, maintain that there is a change from week to week in the amount of heat given off by the sun. The difficulty is accurately measuring the sun's heat. There are six different strata in the atmosphere, between the surface of the earth and 300 miles up. These strata contain several kinds of dust and smoke, and thus foreign matter prevents some of the sunsuffiction getting through. It has been extended that 100 time of dust are saided to the atmosphere each day.

Because of the fluctuating amounts of dust in the air, scientists have gone to the mountain deserts in Chile, to Arisona, California and remote parts of Africa to take their measurements of the suits radiations. The latest observation post was established by Dr. Abbot a few weeks ago on a mountain top in southwest Africa. Here two scientists will keeply gill for three.



Measuring Snowfall

Digging out a snow scale in a Colorado national forest where measurements of mountain move-full forestart how much water is available, as the snow make, for strugetion and power projects

HugeStructures Built Noiselessly

Riveting Hammers May Be Stilled Forever by New Welding Methods in Erection of Steel Girders

By H. C. DAVIS

If YOU ever have tried to do a day a work while a steel hundring was being erected outside your warsaw is a don't you have prayed for the time when someone was it devise a way to silence the enr-splitting rat-a-tai-tat of the riveting guns, producers of nervous chills and rooting headaches.

That day apparently is at hand. At this moment work has been started on the construction of the first large rivetless steel building in the world—a five-story factory for the Westingheuse Electric & Manufacturing Company at Sharon. Pa. A one-story structure of similar type is being erected for the same concert at East Pitts-

horgi, Pa-

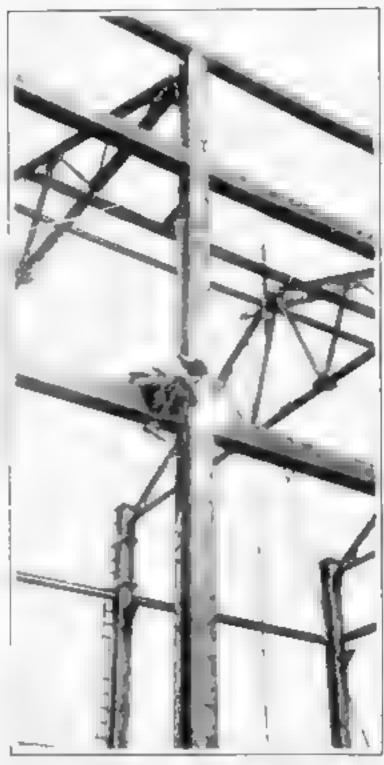
These two buildings, engineers tell us, not only berald a new era or which steel skyserapers can be constructed noiseleoily, but promise a saving of millions of tons of steel a year through economy of material. For notead of being ander by handnered rivets, their gorders beams angles and columns will be "ghied" together by improved not noise of electric are welling. The Sharon but along represents the first practical apol ation of the same ce of are welling to the erection of many-scored but strings.

This revolt among step in the structural steel industry was more possible by months of experiment and test in the laboratories of the Carnegie I istitute of Technology and the U.S. Bureni of Standards. In these tests, various kinds of welded steel members and possis were subjected to terrific loads of many thousands of position, the load being increased in each case

antil the tested material broke under the strain. They revealed the fact, heretofore decined impossible, that welded points, when sesentificially made, not only assure a large margin of safety in building structure, but actually may be stronger than riveted joints.

PERHAPS the most agnificant result of the tests, from a commercial stand-point, was their demonstration that the substitution of are weiding for reveling may result in important savings in steel. For one thing, we are assured, welding does away with thousands of steel plates and angles ordinarily required in riveted bundings. Moreover, it makes possible the use of lighter beams and jurders.

The reason for this, the tests indicated, is that the well-made are welded joint is fully as strong, and often even stronger, than the steel beams it fastens together. It veting construction, on the other hand, requires the drilling of rivet holes through



"Gluing" Steel Girders Together

Perched on the steel alceleton of a high building, the workman above is gluing the structure together by are welding. Note how the absence of civeting joints makes possible complete continuity of line of the beams

the parts to be joined, with consequent weakening effect. Thus the use of the beams often must be determined by the strength required of the joints

In the tests at the Carnegie Institute it was found that in almost every case the steel beams and columns gave way sooner than the welded joints which held them. The tests also proved, it is such that a welded girder is lifty percent stronger than a riveted girder of like proportions

In the Sharon building, about 700 tons of steel will be used. The builders say that this is 100 tons less than would be required if the building were to be riveled.

Although new as applied to steel buildings, the process of are welding, of course, is a common method of joining metal parts. Briefly, it consists of bringing the two parts close together and filling the narrow space between them with molten metal. This is done in such a way that the weiding metal unites with the metal parts on both sides forming a continuous joint. The heat required to melt the welding metal and to heat the surfaces of the parts sethematry to produce fusion is supplied by an electric are which is struck in various ways.

THE close drawback in the past to the use of welding in buildings has been uncertainty regarding the safety of the resulting joints. The welded joint is subject to a number of defects which cannot be detected at a glance, and unless made with extreme care by an expert and subjected to extraordinary tests, it is likely to develop weaknesses that make it all but worthless. Among the most common defects are the formation of gas pockets in the joint the occurrence of scams and cracks, and the lack of perfect forms of the metals.

Since a work point made by a careless workman very often appears to be perfect on the surface, it has been necessary to develop methods of right examination and test. Among the effective methods are interascope and X-ray examination. The penetrating power of the X-ray, it has been found, reveals the interior atructure of the weld, exposing such flaws as gas pockets, cracks, and lack of fusion

The task of welchig steel beams may be compared with glinng pieces of wood together. An expert woodworker can make a glood joint stronger than the pieces it joins, yet

a novice has a bard time even to make the pieces bold together

THUS the job of erecting revetless buildings, it is conceded, is one that requires a new type of skilled ateel worker with expert knowledge of metals and their structure. Whereas at present steel beams are already punched and fitted when delivered to the riveters at the building site, the men who erect welded buildings also must have a thorough knowledge of fitting and assembly.

Evidence of the keen interest in "posse-

Evidence of the keen interest in "posseless building" is found in the fact that at least ten manufacturers are planning to display improved welding apparatus at the forthcoming Fifth National Expontion of Power and Mechanical Engineering, to be beld in New York City in December. Many experts regard the new developments as the beginning of a "noiselessera."



The two illustrations below show apparetus. used by Frenklin in he are sen in espenterm is well in its form meded from At 100 oft. How he slig-Departed the gone ofteted appear of a buck with a spark from the or At he rights. The assisting up through be seen over hanged a he Leeden jor

Benjamin Franklin

America's

First Great Experimenter

How His Grand Energy Mastered Mysterious "Fire" and Gave Us Our Electrical Marvels

ENJAMIN FRANKLIN. the electrician in a familme and an messtable fig-

ure. It is necessary to a proper picture of him. In fact, being the man be was, it would have been impossible for him to avoid being dragged into the magnetic and electrical field of his day, and being the man he was he could not help rushing into it.

One of his earliest impulses toward electricity came to him through the voluminous writings of William Watson. This Englishman, one of the leading early electricians, is credited with baving intraduced the word "errout" into electrical lauguage. He had followed the experiments of Le Monnier in Paris, shortly after the invention of the Leyden par-Substituting wire for chain, Watson demonstrated the great conductivity of this new malerial and, with it and with jars, carried current through the water of a river. Also be convincingly demonstrated the use of the earth as part of a creent. Watson's experiments aroused Franklin's currenty.

Again, there was Peter Collinson. This friend and correspondent of Frankan s was a celebrated English botanist. As a Fellow of the Roym Society, he was in constant correspondence with scientific men everywhere. He contributed to Franklin's Philadelphia Library one of the new glass tubes used for generating electricity by rubbing with a skin. This

BY ARCHIBALD DOUGLAS TURNBULL

gift excited Franklin beyond memore For days, this new amentific toy scarcely left his hands and, when he wrote to thank Collinson, he said

"For my own part, I never was before engaged in any study that so totally engenosed my attention and my time as this has lately done. What with making expertments when I can be alone, and repeating them to my friends and acquantances who, from the novelty of the thing, come continually in crowds to see them, I have during some months, had little lessure for anything else.

Franklin had glass tybes made-"twenty seven inches long, as log as can be grasped "-in order that several tests might be carried on at once, and comparative results noted. He ran through all the "parlor tricks" of those early days exploring guipowder, lighting just extinguished cand es, and charging wine glasses to give, with "electric bumpers of Madeira, comic shocks to his dinner guests. And he made quite a study of the range picture." His directions for hudding this entertaining device were:

Having a large measolint with a frame and glass—suppose of the King (God preserve him)--take out the print and cut a pannel out of it, near two inches ristant from the frame all around. If the cut is through the picture, it is not the

worse. With thin paste, or gum water fix the burder that is cut off on the mode of the glass, pressing it smooth and close, then fill up

the vacancy by goding the glass well with lenf gold or bruse.

Continuous, he described in detail this gilding and reassembling, the pasting of the cut-out part of the picture on the and order of the glass, in exact position, and the placing of a small gift crows to appear as if it rested main the kings heal, part of the picture being behind the glass and part before. Having gilt upon the frame except at the top, that end may safely be held when the picture is electrified and presented to the imporent

ET him, save Franklin "take hold with one hand, so that his flagers low h the golding, and with the other hatel endeavour to take off the crown, Then has body will complete the circuit and be will receive a terrible blow and fail to the attempt to pack up the crown. If the outture were highly charged, the consequences might perhaps be as fatal as that of high treason. The operator, feeling nothing of the shock, may pretend thus to be a test of loyalty. We find the shock fatal to small animals the biggest we have yet killed in a ben."

Franklin's broad humor would not perand him to forego such pranks, but they were always leading him forward. All the study and mechanical preparation in the years behind Franktin were now to be applied to this fascinating force—almost a new one, as far as the world realized it, for all its actual antiquity Fortunately he had sold his paper and his printing and publishing bisnoess for a very comfortable income for his day. Thus, at the age of forty-two, he was in a position to concentrate his tremendous energy and fertile mind upon this branch of science which ower most to him.

AMONG the men associated with him in his first electrical interest were Thomas Hopkmoon, Plulip Sing. and Ebeneser Kinnersley. All of them. became great enthumasts, and each contributed something, either in the way of a discovery or an invention. Hopkinson, for instance, was the first president of the American Philosophical Society, organised by Franklin as the child of the sturdy little Justa and numbering among its members countless noted men whose names and accompaishments have been handed down through the still existent Society Sing and Amnersey both built electrical machines, and both traveled, as Franklin oversionally did, through the Colonies making experiments as they went.

But, while they are given a considerable credit by Franklin himself, the fact seems to remain that his was the master mind and his the guiding spirit which they eagerly followed. This, when Kinnersley wrote complaining of the breaking of his instruments, through the roughness of 18th Century travel. Franchia immediately replied with a design for a portable machine which would not be injured on a journey. These four men soon made all the experiments reported by Watson, Collinson, and others in Europe.

Presently, however, Franklin produced an original experiment, the one commonly known, at the time, as "denwing off and throwing off electrical fire"—this term for the force being then in general use.

THE preliminaries consisted in putting a round shot, about three inches in dumeter, in the mouth of a dry bottle, and suspending, beside the shot, on a silk thread, a bit of cork. "Then," explanged

Franklin, "electrify the shot, and the cork will be instantly repelled. If, now the point of a bodkin be presented to the shot, the charge will leap to the bodkin, the repellency will he destroyed and the cork les back to live shot That experiment illustrated the way in which two conductors become charged with "opposite" electricity. When these two charges become strong enough, the air between the conductors is "broken" and a spark passes. Also, the experiment proved how readily a pointed conductor attracts or gives off current, as compared with a blunt one.

In our day of wave lengths, spark gaps, neutrodynes and londspeakers, all this may seem child's play. But, in Franklin's lifetime, it constituted a thriling scientific docovery, with the most far-reaching consequences. In fact, it was a fit fure-runner of the "make and break" telegraph which made the Morse code possible.



Franklin's Armonica

This is the massest instrument invented by Fronk in its serves of tuned gams bouls of varying ergos, all mounted on a spendie which was turned by a trendle. Tunes were played by drawing the linguist over the revolving glasses after they had been measured with a sponge. An advantage of the peruliar instrument to Franklin pointed out was that once well tuned, it never made returning.

The success of the experiment, an Franklin further demonstrated, was materally affected by various conditions. Sifting fine mad on the shot destroyed the repellency gradually. Breathing upon it, or "making a smoke about it from burning wood, slid the same. "We sappose, auggested Franklin, "that the particles of sand, moisture, or smoke, being first attracted, then repelled, carry off a portion of the charge, but that the same at II ambeists in these particles till they communicate it to something else, and that it is never really lost. So, when water is thrown on common fire, each particle of water curries off its portion of fire." Currently enough, he adds, a lighted candle, even at a foot distance, destroys the repellency "suddenly."

From these experiments, Franklin de-

duced het well-known theory of electricity as a fluid, moving along autable conductors and readily accumulated in proper receptucies. He declared that electricity must exist in all boxies, the "common stock," as he classified it, being raised or lowered by abnormal influences. Thus, he said, meant that bodies were at times overcharged, a condition

to which be was the first to apply the, term "electrically positive," or undercharged, which be described as "negative," From positive to negative, he argued, there must be a flow of current In this connection, he master that electricity was not created by friction, but merely collected, maintaining that the glass tube, when rubbed, simply served to "attract the electrical fire."

IT IS quite true that there have been, and are, other accentible theories—electrons, and the like—which have since been suggested by the great men in this field. But, whatever the true explanation of the force, the fact is that Franklin's will always remain the world's theory; that is, the theory which is easy to understand, plausible, and picturesque for the man or woman who is not an exact scientist.

In advancing his theory and in describing his experiments to support it. Frankin was not, of course, always absolutely certain of his results, nor prepared to expan a everything he encountered. At that period of history, at was hardly to be expected that he would be Accepting these shortcomings, he put the position in his usual

pithy way

"It is of real use to us to know that clubs, left in the air unsupported, will fall and break, but how it comes to fall, and why it breaks, are matters of specialisms. It is a pleasure indeed to know them, but we can preserve our clubs without that."

In other words, we must accept some natural laws or phenomena, even if we are unable fully to explain them.

Bi T Franklin homself was rarely willing to accept the unexplained phenomenon. For instance, he gave much study to the Leyden jar. This jar is generally exedited to Von Kleist, Richop of Pomerania in 1745, though some say the inventor was ready Cureus

of Leyden, the city for which the par is named. Essentially, the jar is merely a glass bottle, costed on both the outside and made with his foil, leaving a good free space between the mouth of the jar and the upper edge of the tan foil. If the mner coating is connected to a machine producing electricity, and the outer conting is connected to the ground, the jar then proves its power of necumulating electricity, Even if the machine is a very weak one, it will produce strong charges when connected in thus way with the jar. In the early jazs, the top was



The First Bifocals "Helped His French"

A BOVE is Franklin's own design for the first double spectron. Requiring two sets of lenses, one for reading, another for distinguishing distant objects, he hit upon the idea of the split lens. "By this means," he wrote, "as I were my spectacles constantly, I have only to move my eyes up and down, as I want to see distinctly far or near, the proper glasses being always ready. This I find more particularly convenient tance my being in France. . When one's ears are not well accustomed to the sound of a language, a right of the movements in the features of him that speaks, helps to explain, so that I understand French better by the help of my spectacles."

closed by a cock, through which passed a braze were ending in a knob outside and connected by a braze chain to the inner

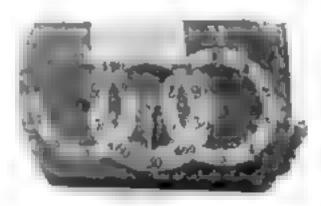
creat mg

Frank in, on the bases of his theory of electricity, explained the Leyden par as a container, in which the inner foil, receiving from the machine more than the ordinary quantity of electricity, became "positive, while the outer foil, losing electractly, became negative. To show how equilibrium could be restored, he made a number of what he called "prefty experaments. " In a dark room, he connected a length of wire, bent in an arc, to the "gold-filleted" cover of a book. With the book lying on glass, close to a charged jar, he took off a spark from the jar, with his wire. The spark illuminated the gold cover in a way which he described ns "vivid flame." Again, he attached a wire to the outside coating of the parfixing it upright, parallel to the wire coming out through the lid of the jar Hts of cork, hung between these two wires, would "play incessantly" between them, mutil the whole jar was discharged. That is, eastwesty would be "fetched from the sande coating to the outside conting antil there was no more to fetch. These experiments were, of course, ertors sleps in the direction of what war later to be known as Yolla's battery.

IN EUROPE, at this time, there was much discussion of the Leyden jar, with many different explanations offered to account for its holding electricity as it did. One man held that the charge really rested in the person who held the jar. Another masted that the charge was in the water with which the jar was partially filled. A third—Watson, for example—insisted that the charge was all in the inner conting. Refusing to accept any of these explanations, Franklin proceeded to look for the true one

To begin with he placed the jar on glass, in order that the charge, wherever it ought be briking, should not run away from him. Pulling out the cork, with its inserted wire, he held the jar in one hand and put the other hand into the water. (retting a spark, or shock, he promptly concluded that the cork and its wire were eliminated from the problem he had set himself

Next, he recharged the par and put it back on glass again. This time, he not only drew out cork and wire, but also carefully poured the contained water into another uncharged par. Thrusting his



Foreinther of Speedometers

The adometer used by Brayamin Pronklin and later by Thomas Jefferson. It was an instrument for measuring the revolutions of a curriage where, to which it was attached

fingers into this, he found—pothing. On the other hand, when he poured fresh water "out of a tempot" into the charged par, it promptly gave him a shock, Therefore, he concluded, it was not the water steelf which carned the charge.

Upon thus, he laid a pane of glass flat on his hand, covering its upper side with a lead plate, thus pitting his glass, like the glass of the jar, between two conductors, one lead, the other human. Carefully charging the lead plate, he got a shock from it, which proved to him that the shape of the jar was of no importance.

Finally, he took two plates of lead of equal dimensions, but shorter by two inches each way than the glass he placed between them. Having "electrised the glass between, by electrifying the upper plate," he drew the glass away. In doing

this he drew out what little "fire" might be in the lead, and the glass, being touched in the electrised parts, "afforded only very small sparks." Replacing the glass between the plates he completed the circuit between the surfaces and immediately "received a violent shock." The problem was noticed, and he had solved it. Obviously, the charge really rested on the surfaces of the glass, the tin foil contings serving to keep the charge spread evenly over that surface. In other words, the Levinen jar was what is now more commonly known as a "condenser."

Naturally, he wrote of all this, at great length, to Collinson, who immediately published his letter, with others. The English, at first, showed a tendency to laugh at the "American amateur," but they were not long in admitting that he was making amazing progress. In France, of course, where Poor Richard had been Franklin's highly successful ambassador, his discoveries wan instant recognition and fame. It gradually became, in Europe, quite the thing to hear what Dr. Franklin had to any over in Pobladelphonmas much so as it was the thing in the city itself.

IT WAS only one step more to the con-structing of want Franklin speaks of as an "electrical lastiers," probably the first known. This consisted of eleven paner of large each glass, armed with thus lead plates, pasted on each side, the pages placed vertically and supported at two inches distance by salk cords with thick moder of lead wire. These wires, saya Franklin himself, were "standing upright, distant from each other, and with convenient communications of wire and chain made from the giring side of one pane to the receiving side of the other. So the whole might be charged together and with the same labour as one single pane. There was another contrivance to bring the giving sales, after charging, into contact with one long wire, and the receivers with (Continued on page 147)

Newest French Destroyer Has Tough Shell

THE latest ideas in played semament against see or pir attack are embodied in the new French "Jaguar" type destroyer pictured at the right. Notice how the bow guns are almost completely shielded, also the bombproof canopy proeting over the deck The navigating house, too, is heavily armored, as is the bridge at the right.

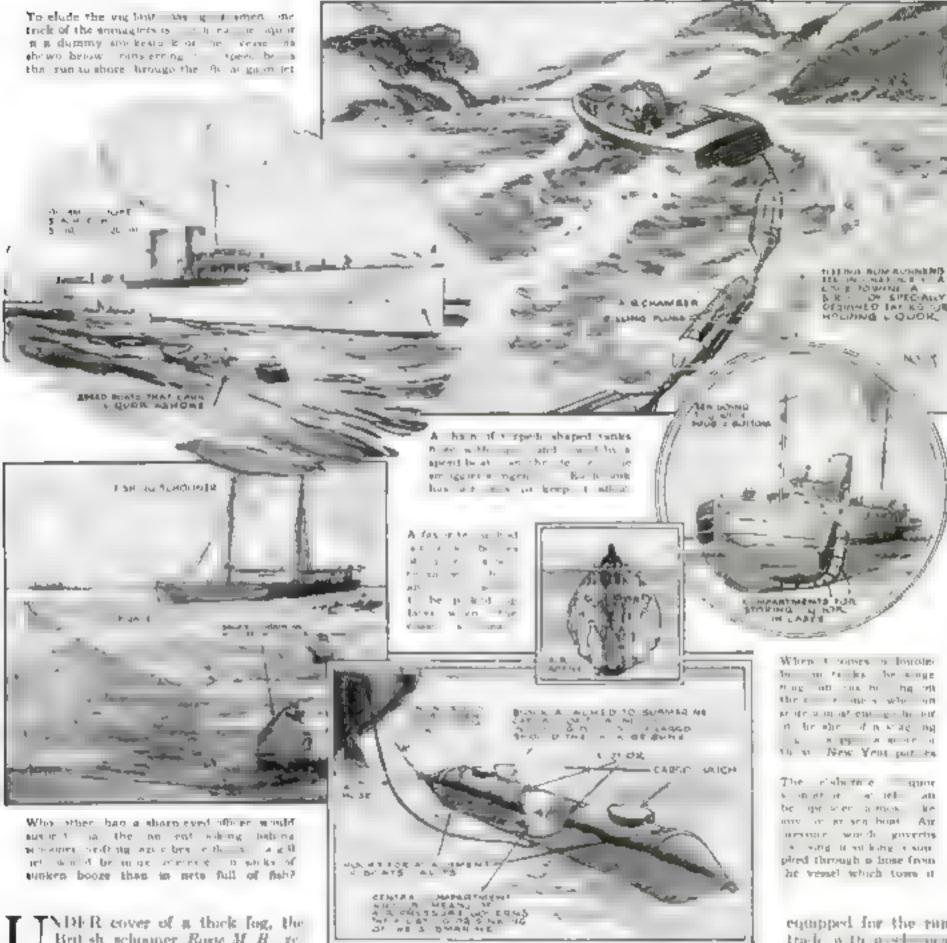
This new 2400-ton fighting machine would dwarf the largest destroyers of twenty years ago, which displaced only 600 tons.

In the distance at the extreme left may be seen one of the new French cruisers of 10,000 tons, with its tripod masts and bridges.



Amazing Tricks of Rum Runners

Smugglers Devise Ingenious Ways to Elude Coast Guard



Beit sh schooner Rosse M H | recently beeled swiftly in toward the coast of Long Island off Montauk Point.

It was the Rome's seventy fifth trip, and her adventurous crew already felt in anticipation the crinkle of crisp American dollars in their fingers.

BOOM!

A shot passed across the deck from a ghostly prow cutting through the heavy most ahead. The Rome swung about in a panie, and headed back to sea.

BANGI

The Rosie brought up short, and some time later floated sheepishly into port, in tow by the Coast Guard cutter Mc-Dougal.

federal inspectors found twenty tanks shaped like torpedoes, with rings at the end for towing, and air compartments to keep them afford, and eighty-three stationary tanks used for storage, all for transporting contrahand liquor from "Rum Row" to the American coast.

On this page, our artist has pictured other ingenious methods used by the boose amuggiers in attempting to break through the vigilant Coast Guard to the market created by Prohibition. All the devices shown have actually been used

All kinds of seagoing vessels have been

When I comes a longite to an to ke be a night ering with this bit thing with the control with and professional entres to be tell in the other of he shade ma-

s in its ite as tell and mession worth grouping a world life at higher a sugar pired through a hose from he wested which town it

compact for the runtrack with post-year skill and ingenity of

When the vessel was searched the the highest order The craftiness of the smugglers, and their expertness in unvigation, is surpused only by the keenness of their antagonist in discovery and

> The activities of the Coast Guard have decimated the ouce-populous Run Row A year ago, an average of fifty ships were at auchor off the "Row" now there are only about five or six. The principal points of contact lie between Cape May, N. J. and Cape Cod. Mass., and in the Guif ports. On the Pacific coast there is little or no smuggling, as the shore is rocky and landing is extremely hazardous.

Why MEN Beat WOMEN



GREASE-SMEARED and weary, but uniting, Mass Gertrude Ederle waded dripping from the dark and chilly Stratts of Dover one evening recently, and walked into the ruddy glare of the defitwood fires burning in her boner on the beach at Kings tore the first woman to swim the English Channel

The broad shouldered and stout-

hearted American girl had good reason to strile 50e had done more than win the high honor of being the first of her sex to sw m the twenty sonemale stretch of ourrent-wracked awi storm-swept salt water that up to then had defeated all but five of the many powerful male swimmers who had challeaged its might more than set a new record of 14 hours 91 minutes for the natatorial passage from Cape Gree Nes in France to the English coast.

For the first time in sport history a woman had out-done man's best in a task demanding to the full the qualities of speed, stamina, skill, and red, raw courage. Within a few weeks another woman, Mra. Clemington Coron (Mille Gaze) of New York, mother of two chiedren, struggled through the breakers beneath the white Dover cliffs and strode up the beach the second woman to swim the Charact. Her time for the crossing was an hour slower than Miss Ederle's, yet it surpassed by an hour the record of Selastian Timboschi fastest of the male Channel swimmers up to that time.

More than one man gamed his eyes dazedly. Woman, having made good her invasion of many other flesos of entervoronce wholly masculate, now was competing against man on equal terms in sport—and beating bins at the hardest of his own games! The male a world-old boast of physical superiority seemed to have become decidedly shaky,

AND then, forty-eight house after the news of Mrs. Corson's feat was broadcast to the world, the Channel was conquered again, this time by a man, Ernst Vierkoetter, of Germany, in the fastest time ever, 12 hours, 43 minutes an hour and forty eight number better than Trudy Ederle had done Less than two weeks later another man, tosseges Michel of brance, bettered Vierkoetter's time by one hour and therty-eight number for three hours and therty-six number faster than M se Ederle's.

Which was as it should be fir, despits male frace and featurine achievement, man remains supreme in sports, and, in the opinion of many experts well qualified to judge, will remain supreme in sports for many generations—probably forever

Why?



Nineteen year-old Gerrrude Ederic, so she entered the water to swim the English Channel She outswan all previous swimmers but a men soon broke her record

Suzanne BeatsWomen

The greatest woman tennis player in the world has been besten repeatedly by many second-rate men sters

at SPORTS

Feminine Stars Who Make World Gasp Still Lag Behind Men, and Always Will Experts Tell Why

By ARTHUR GRAHAME

Although it is only in the last few years that the doings of women sport stars have been featured in our newspapers, there is nothing new in women's participation in some of the highly competitive athletic aports. Our first women's national tenns chaispionalup was held almost forty years ago. Our first women's national golf championship was played back in 1805. In 1904 Muss blay Sutton found it possible to play really highclass tennis even while handscapped by a volumenous duck skirt that flapped about her ankles and a shirt waist with wide alceves. Women proved their love for sport by ougaging in it while wearing the clothes they had to wear in those days?

WillLE terms and golf were pos-"sport" clother of the early years of the current century, speed swimming and track and field attaches, the two other branches of sport in which the woman of tomay has shown the most interest and the greatest ability, were next to mapossible. No girl could run fast or swimfast while lumpered in every movement by the chaging folds of uscless cloth demanded by a convention of false modesty. It was not until the dawn of the present "jazz" age disclosed the startling fact that girls have legs like other people that woman ducarded the senseless athletic clothing that had hampered her, and began to make real progress in sports.

That progress has been startlingly rapid, but in every sport there still remains a big gap between the best performances of men and the best performances of women. And

in the opinion of most sport experts, women athletes will never be able to close that gap.

It is in swimining that women have approached most close-ly to the musculine at an dard. Mass Ederle, indeed, has aurpossed that standard in some swims in open water. But in the shorter events the men lead by a good margin. Miss Manechen.

Webselau's women's world record for 100 varils in 1 monute 8 seconds: Johnny Wessemiller's men's world record is 52 % 5 seconds. Mass Ederle's record for 150 yards is 1 minute 45 seconds. Wessemuller's record is 1 minute 27 % 5 seconds.

Lot IS DE B. HANDLEY is considered to be the world's greatest authority on swimming. As volunteer coach of the Women's Swimming Association of New York he developed Gertrude Ederle and many other recordbreaking girl awanners. I asked him if women ever would be as fast as men in the water.

"No." and Mr. Handley, "they will not. There are biological differences that make it impossible. A woman's boddy conformation causes too great resistance to her progress through the water. Even the extremely thin woman a handicapped

heavily by this fundamental hodily difference. At present there is a difference of ten seconds in a hundred yards between the fastest man and the fastest woman



Coming Ahead with Giant Strides

Helm Filtey. America a champion women all-round othlete, hurding in excellent form. Women track and field athleten will always ing behind men, experts thy, because of their interior speed strongth, and staminh

swimmer. Possibly some woman sometime will be abse to leach that difference, but no woman speed swimmer ever will be able to equal the records of men."

"That being so," I asked, "how do you account for Miss Ederle's remarkable time for the Channel swin"."

"At the time she made the swim," he and, "Gerteuie Ederle was the fastest swimmer, man or woman, who ever had attempted to swim the Channel. Men of Weissmuller's type are much faster than she is, but they lack endurance for so long a swim. Women have one great advantage over most men for distance swimming—they have more fatty hashe on their bodies, and this fatty timue incremes their honymey, mereases their endurance, and protects them from cold, Good women owimmers are being developed all the time. But the fastest of them never can hope to be as fast as the fastest men. Man will hold on to ha present advantage in the water,"

GOLF would seem to be one widely popular sport in which women and men could meet on an equal footing, for in golf skill is of much greater value than strength. Yet in golf the gap between the best women and the best men is as wide as in other sports.

Speaking of her match with M is Joyce Wethered in the B. tish winners chain probable last year, Miss Glegon Collett our national champion in 1922 and again in 1925, remarked that Miss Wethered is as perfect a golfer as a woman can be with the handicap of being a woman." Asked if she thought that a woman golfer ever would be able to beat a man, she countered by replying "Li hate to be able to beat a man."

Mess Collett is known as "the girl who can drive like a man." She can, in fact, drive a longer ball than most men—she averages about 200 yards off the tee—but her drives stop fifty or sixty yards short of the (Contoned on page 152)

A Diminishing Handicap

Two pictures of May

Button Bundy, for
mer woman's tennia
champion: in the
approved tenns contums of twenty years
ago and as ahe
is roday. Women's
progress in beanu has
kept pace with the
abbreviation of her
ekirts, Short as they
are now, they are
etill a hand-cop



Chemists Conjure Up

A Dazzling Vision of the Future

By their magic they may provide us with substitutes for all we need when nature's supplies fail. Marvels already achieved

By Newton Burke

Of need not fear that the bosom of the earth, drained by the demands of increasing multitudes, will ever cease to supply you, or future generations, with the daily needs and comforts of life,

from endless labor among the relative and lest tubes of their laboratories, a comber of America's foremost chemists and experimenters passed, a few weeks ago, long enough to offer this positive essurance. Assembled at the Institute of Posities at Williamstown, Mass. to compare notes and take stock of the fixture these scientists moted in proclaming that we who live today are entering a new age of miracles—an age in which main no longer will be bound by the bustations of the earth's supply of raw materials, but will be the master and the creator of all that he needs.

With the Age of Stone and the Age of Bronze long past, they pointed out, weiftly now we are leaving behind the wonderful Age of Iron and Steel, and are entering a new era of chemical mage—the Synthetic Age.

The Symmetre Age, they explained, is an age of element ejection in which dwindling natural supplies of such necessities as food, fuel, himber and metass are being replaced by manipude compositions of the laboratory

as not fine teamy.

To know who have been warning of world famine in these necessities, they replied, in the words of Dr. Charles L. Pressus, secretary of the American

Chemical Society.

"You may deep well, you, your children, and your children's children. Already we vision how to make wheels forcish their own hibreant and the energy to make them revolve. Chemista are modest men, but they admit frankly that they can make the world go round."

Here are just a few of the muscles of the Synthetic Age, some of them already register, others promised for the future:

Power been discovered for producing synthetic roll and gasoline from sawdist and other wood wastes was also demonstrated recently by two chemists. For the possible may when the supplies of coal and oil shall vanish, scientists expect to unleash the endless energy of the atom. Dean Gerald L. Wendt of Pennsylvania State College is one was predicts that at the present rate of discovery it will not be long before that form of energy is used.

He points out that a given weight of radium holds 10,000,000 times as much energy as any known fuel. Uranium, too, which is a comparatively common element worth from \$8 to \$10 a pound, could do all the work of the world. One pound of it contains enough stored-up power to equal 100 tons of coul, and two tons of it could light New York City for a year

And even if the atom should refuse to give up its energy, there still would remain the sun. Henry L. Doberty noted New York engineer and financier, said that "no long as the sun shall continue

The Synthetic Era

WE HAVE heard of late many disturbing foremets concerning the fixture fate of the world. We have been warned by community of the absencing rate at which we are using up the materials which miture supplies for our needs,

On this page is the answer of the observate, those men of magic who holdly delve into dark accrete of the universe and bring forth new treations. Leading us to the threshold of a new age, they reveal to no accumulty endless new sources of wealth beyond anything which nature has devised.

to shope we will not be without the power to create all the energy we need.

SYNTHETIC Ints. including butter, even now are being produced with little difficulty. They can he made from petroleum, acetylene or natural gas. Only a few weeks ago a British chemist produced a synthetic augur from carbon dioxide and water By adding nitrogen to the same combination, the chemista expect to produce compounds similar to proteins. American chemists have made sugar also from corn and from sawdust. Others are promising us artificial "beefsteak" from cutton need. For the future they predict that the pecterns and carbohydrates needed for human diet will be created in the factory rather than produced on the farms.

According to Dr. H. E. Barnard, president of the American Institute of Baking, "it may be that generations yet unborn will derive the major part of their food supply from the nutriments synthesized in a few hours. Thirty men in a factory the size of a city block," he adds, "can produce in the form of yeast as much food value as one thousand men working on seventy-five thousand acres of farm land under ordinary agricultural conditions."

Meanwhile the fertility of the soil is being repleashed by chemical processes, notably by the discovery of methods of extracting intrates from the atmosphere. Eventually, we are promised, one food will be obtained artificially from the light of the sun and the introgen in the air in much the same way that plants are made to grow and lear fruit. Even now experimenters have made definite progress toward discovering the secrets of the

chemical processes that go on within growing plants, and they foresee the time when these processes will be diplicated and controlled by man,

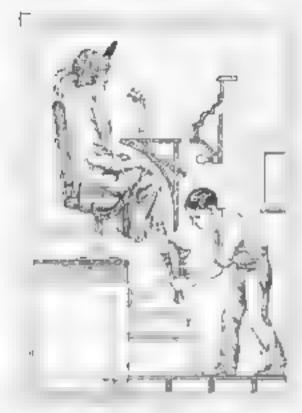
Clothing TODAY we have on, the synthetic alk which duplicates nurvelously the natural product of the sokworm. Waste from rayon is being converted into yarn and mixed with real wood for the manufacture of serge and summer goods. Artificial smoc leather is an actuality. The Germans are making artificial estion from prac needles. And in Italy a synthetic wool has been developed from pulpwood, while in Engined vegetable fibers have yielded another wool substitute. As for dyes, the creations of the chemist's laboratory years ago were substituted for the coloring matter obtained from plants, shellfish and various other thongs.

In 1897 for example, a million acres in India were used for growing the plant from which maligo was obtained. Today only about one percent of the world's supply of indago comes from the satiral source. The rest in synthetic indago. Before long the well dressed man or woman of the Synthetic Age, we are told, will be proud to doplay artificial gar ments exclusively fashioned by the chemists.

AS LUMBER grows Materials precious, scures of lumber substitutes have been made avanable. Among them are asbestos and composthen reofings; composition beards, some of them made from the waste of sugar cane: artificial stones and coment penducts. Steel, too, is coming into use for homes as well as for office buildings. Even ordinary glass windows are being. replaced by new nonbreakable chemical products. Pleable glass, one of the many synthetic resingus products, is one of the recent discovenes, and an art ficial good keeps out the cold and lets in the curative rays of the sun.

This process of substitution, we are told, also will be extended even to house furnishings and (unhaved expert 1)

Curious Ideas of Inventors



A Decorous Shoe Shine

The warrian wire patericed this class care at inpor along against in 4.5 eventory or here it benesi femonie go bia fa e t fore posses as a row in the book that k. All and rite also equipped his atend with a tempte no One agh while the partie might all ermounts to the stone but. This was in the before short skirts, so of course risps were provided to hold the dress about the sakles

Rough on Rats

"Illuminated Cat for Frightening Rate and Mice to the little of a patent granted in 1884. The figure of a car is rosted with a substance to make it shine in the dark and treated with oil of pepperment which, the inventor claimed, in "obnorwus to rete and reice. The entired's eyes glow with phosphorus



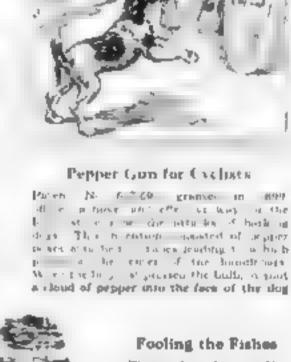
Strange and Ingenious Devices Found in the Patent Office Records





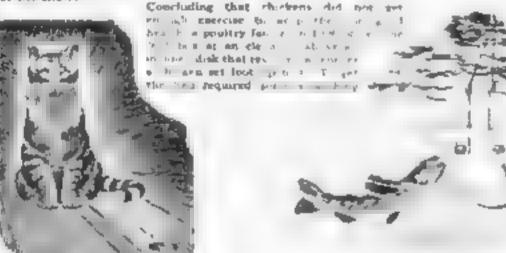
A Sport for Fowls

Concluding that checkens did not get han him positive force in 1999, or a to the me man eller or en time distribution of a concero he are set loot at to 2. T get the held required policy a such ey-



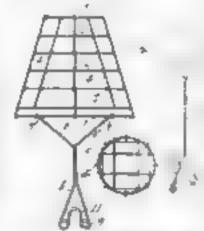
Fooling the Fishes

The angler who is 1894 devined a mirror lure for fishes set the left also told why it should works "The lish, when approach ing the but, we, see the reflection of himself in the numer and will be made bolder by the supposed companionably, and mere enger to take best before his competitur under it?"



A Ventilated Bonnet

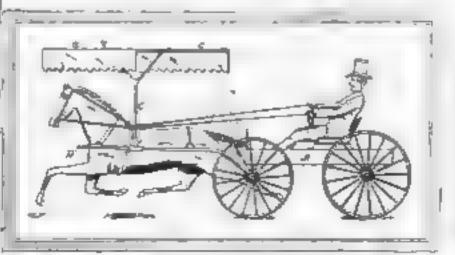
The year 1917 brought forth the most original des in women a hats at the right. It consists of a frame tied to the shoulders and supporting the bat above the wester's head. 'This arrangement, and the strentor permits the free consistion of states been a chieffe ban rie tion of the trimming of the wenter a hear and of the but





For a Night in the Day Coach

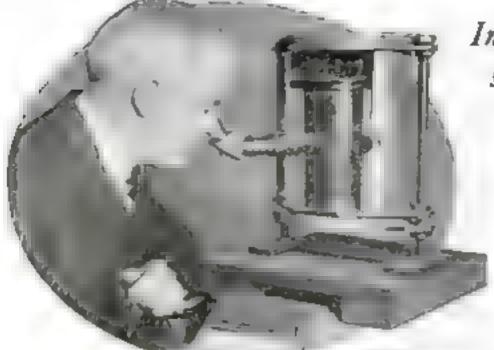
One night's attempted sleep in a day much, back in 1889, impired a traveler with inventive mind to create this "treat hammock." hammock is sung from the backs of two seats by rouses of hooks. Henceth the forward hooks is a sling which supports the sleepers legs



Horse Awning

Something more stylish than strew bombets for horses was the sun of the inventor who, in 1888, conceived the idea of an elaborate awning to be suppirted by the shafts and to shade Dobbus from cope to tail. Notice in the inventur e patetit drawing at the left the dotted limes addenting how the awnion m the be folded back out of the way on statem days

Strange New MARVELS



Invisible beams count automobiles, signal aircraft, give us radio, cure disease and work other astonishing miracles

Or. II. A. Milliam, of the California Institute of Technology, with the denoting apparation with which he inolated the shortest rays known. A busion of these counse waves would be the thickness of a capacitic paper. finger nails, from certain drugs like quinine and from many other substances.

These are effects of another form of invisible light called ultra-violet rays,

The incidental have described illustrate only a few among the modern marvels of light rays. The photo-electric cell that the two men used to count the automobiles is a device to change light into electricity. A small beam of light was sent across the condway from a lamp. It entered the photo-electric cell, where it became an electric current. The roadway was wide enough for only one car. Whenever a car passed it interrupted the light beam. I but made a break in the electric current The apparatus attached to the cell counted one car at a time.

It wol'LD have been just as possible to make this device entirely secret. A visible light beam was not necessary, instead, the two men could have used one of General Ferriés invisable brutio. The count could have been made with no one any the wiser, not even the traffic police-

These plots-electric cells are among the newest of the light ray devices, but they have already found many uses. They measure the density of arroke from factory channeys, they sound the alarm automatically when electric transformers begin to overheat and send up tray wasps of smoke; they take the time automatically from the stars when a star image crosses the spacer web line on the astronomer's telescope, they sent eigers automatically into chance depending on their shade of brown or red; they determine the exact amount of light needed to grow plants well in a greenhouse.

They are performing every day dozena of other tasks like these, tasks which science or industry walks done automatically and infallibly.

NOT the least of their marvels is their speed. In the automobile count made in New York it would not have mattered if the light beam had been pointed in the other direction, provided it could have been induced to curve around the earth as radio waves do and to come back to the starting point. For this light beam could travel around the earth in less time than an automobile, going fifty miles an bour, can move its own length.

The speed of light in miles is very closely 186,300 unles a second, a figure the exactness of which we owe to Professor A. A. Michelson of the University of Chicago, Professor Michelson has spent the last

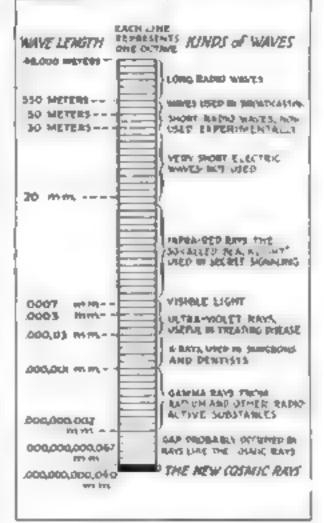
I WO men were given the job a few weeks ago of counting the automobiles which pass a certain point on one of the atreets of New York City. They did the job perfectly, yet neither of them counted so much as a single car. For hours at a time both of them were away on other duties, yet the count went on uninterrupted. Even when the two were there, they paid only the most casual attention to the stream of cars rapidly moving past.

Is the a puzzle? Am I about to answer it with some transparent trick, such as telling you that the men had first hired someone else to do the counting for them? By no means. The incident was a straightforward scientific experiment. The two men used rays of light in connection with the new electric eye called a photoelectric cell, to do the counting for them.

Some years ago General Gustav Ferré, the distinguished scientist who heads the ratho service of the French Government, discovered that a beam of acceptable light could be sent across from one ship or shore station to another. Over this in visible beam dot and dash agains can be sent, as they are sent over the visible beam of an ordinary search! ght. The enemy cannot read the aignals. They cannot even see the message-carrying beam.

In producing this new marvel of science, Ferrié was guided by the knowledge that light can be invisible. Indeed, the invisible kinds of light are far more numerous, and probably more important, than the visible kind. What the general used was a beam of "black light," a variety of light ray investigated during the war by Dr. W. W. Coblents of the United States Bureau of Standards, and well known to scientists since.

PROFESSOR R. W. WOOD, head of the department of physics at Johns Hapkins University, stood one day in his laboratory with a number of visitors. The r som was darkened and filled only with a dim purple glow coming from a lamp which the professor was demonstrating. One of the visitors opened his mouth to ask a question, and everyone except Pro-



Man's Newest Tools

Have are all the other waves we know, from the longest ones at the top to the abovered tot the bottom arranged in a scale division in octaves. Through we are only beginning to understand three rays with their varying properties, the things we can already do with them we mystifying and automatons.

fessor Wood started back in astomshment. The visitor's teeth were glowing with a greenish light as though they suddenly had caught fire.

Let this was no magic of modern alchemy, no ruse of the professor's to astonish his friends by smuggling some harmless form of phosphorus into their mouths and unto their treth. It is merely another of the marvels of light rays. Emitted by the professor's lamp, a form of invesible light—a different form, this time, from the black light of General Ferrié—struck against the visitor's teeth and made them glow. The same glow can be elicited from pearl cuff buttons, from

of LIGHT

By E. E. FREE

three summers on a mountain top in Calgorna, making this ligure still more car-

something which Can travel around the carth two or three times while you wink your eye is not a job to be tackled lightly It is like toying to catch the speed of a rifle bullet.

with an eight-day clock.

NEVERTHELESS Professor Michelson accomplished it, with the help of two bittle corrors and a couple of mountains. On one of the monetains was the peofemor houself with a powerful are lamp and one of the marrors. This mire

ror was built in an eight-aided shape, like an octagonal checker with the nurrors on the eight edges. Thus could be rotated,

like a spanning top.

Off on the second mountain, twentytwo m les away, was the other meror. It stood still. A cay of light from the rotating mirror was shot over to the other mountain top. There it hit the second marror, which promptly shot it back again. Professor Michelson received it on the octagonal mirror when it returned. Measuring how much the octagonal mirror had moved while the light ray was away, and knowing the speed of the octagonal meror, he calculated the fraction of a second which the light my last occupied in traveling the forty-four index to the other mountain and back.

IT IS partly because of this entrinous speed that light is so useful to mankind. It is what makes light trivel in bnes which are so nearty straight, so that surveyors can use sight lines to lay out caties or to test the vertical ty of buildlags. Our whole idea of time is due to light, for all our clocks are set by the light cave from the stars as they enter the telescopes at the observationes.

The exact measurement of the speer of A Secret Communication System Or 15 to C. blebt and the U.S. Harrison. Stephands main win bir the season bands again. A set free at the same of

> If some malicious magician laid the power suddenly to abolish light, thin would be an astonishing world. You would probably think you were stricken blind, for there would not even be a gravness, not even deeper standows in the total blackness, as you groped about. But that would not be all. Your automobile would not see even if you were widing to chance to many at blindly. The gasoline would not explode in the cylinders, for it is probable, scientists now believe that certain light rass set free mode the cylinder and acting on the gases from the gassame are essential to the proper operatant of the engine.

> WITHIN a few montes the earth would begin to grow cold. Before a week everything on earth would be frozen solid. Net even your radio set would serve to inform the public of the cutastrophe as rado did so well during the late strike in Great Britain. Hadio itself is merely a form of light.

> This carious fact was suspected by Hemreb Hertz, the brillant German physicist who discovered radio waves nearly fifts years ago. He even built some queer-tooking parroes of copper-

shes to mad some still queezer "lesses" of copper wires, by which he succeeded in handling his radio beams a good deal the mme way that we handle visible light,

The best proof of the identity of radio waves and light was not obtained, however, until about three veers ago. The late Dr. Ernest Fox Niebola and his associate, Dr. J. D. Tear, then successful in measuring radio waves on a lightmeasuring apparatus and also in detecting light waves on a radio apparatus, thus preving the two to be the same.

The radio waves differ from ordinary, visible light waves in the same way in which the waves of the ocean differ from the apples on a tube f water. Radio waves are long; light was or are short. The shortest radio waves measured by Dr. Nichols and Dr. Tear were a fraction of an arch long far storter than the waves used in broadcasting, but still far langer than the waves of visible light.

THESE visible light waves are so short that it takes therty or forty thousand. of them to make one men. In between them and the shortest of the radia waves he the waves of heat and of the "black light of General Ferric

I was standing one afternoon on the street when I was suddenly struck in the face by a blast of heat. There was no hot

gos, as from a flame; and no shock, as from an explorion. In a moment I identified the source. A great electric heater like those used in households, but larger, was mounted on an automobile truck. Power was evidently supplied by the engine of the truck. An operator turned the great copper reflector this way and that, so that the people on the street would feel the heat and have their attention attracted to ((outstand on page Jul?)

How the Speed of Light-Fastest Thing There Is-Was Measured



It's Easy to Fuel an Oil Burner

But make sure beforehand that the right grade of oil is available—What you should know about your new fuel

By P. E. FANSLER

Different types of oil hursers require different grades of oil fuel. Therefore, before you actually hay a hurser, ascertain that oil of the proper grade for it can be purchased in your locality. Any reputable oil dealer will give you full information about the oil fuels he is prepared to supply, and a little knowledge of what the actual difference is between various grades of oil fuel will help to your understanding of your burner and its needs in fuel.

Crude petroleum, as it comes from all wells in various parts of the world, is not a definite chemical compound. All cross petroleum is a mixture of many different compounds, and the proportions of these different compounds are not always the same. All of these compounds are compounds are compounds are compounds are compounds are

gen and carbon in varying proportions. The petroleum taken from wells in one part of the country may differ greatly from that from other localities

Cende petroleum is spirt up into its parts by the dilaton. As heat supplied to crude petroleum the first material to be driven off in the form of yapor is gasoline. Next comes kerosene, followed by a ring ber of compounds each of which is driven off at a different paint in the boiling process. Among these are the oils called "distillate." "gas oil," "Discelled." "furnace oil," "solar oil," and so on, the exact title depending on the locality. In other words, while "furnace oil" may be a trade name for a fuel that is

practically colored kerosers in New England and along the Atlantic coast in the Abade West the same name coast in amplied to a straw-colored distillate of an entirely different grade.

THE specific gravity of an oil deterionies at a characteristics as a fuel regardless of the name under which it is sold. The actual weight of a gallon of each of the hydrocarbon compounds that

form crude petroleum is slightly afferent from that of its neighbors in the mixture. A gallon of pasoline, for instance, weight less than a gallon of kerosene, and the kerosene, in turn, weight less than any of the various grades of oil distilled after it.

I intend of actually weighing a given oil fuel, the relative weight is determined by an instrument like the hydrometer the hattery man uses to test the storage hattery in your automobile. All the oils suitable for use as fuels under any conditions register somewhere between 12° and 72° on the stem of this

instrument, which is marked with what is known as the Baume scale. High grade gasoline tests to the latter figure, while crude oil may read as low as 12° Baume.

Oil burners of the kind used for home heating require facts that register between \$1° and 40°

The Underwaters' Laboratories, when being an oil burner at approved after test, always specify the lowest grade of oil with which the burner will operate satisfactorily, and the Underwaters do not past any atmosphere burner for use on a large scale. Gasoline, kerosene, and the very lightest of the oil fuels may be used with a burner that makes gas out of the oil by preheating it in a pipe exposed to the flame of the burner, but to hurn the heavier and less costly oil fuels from 35° down to 24°, a burner that operates on a different system must be employed. Mechanical means must be used to break the oil up into fine particles and these particles are then turned into gas by the action of heat mixed with the proper quantity of air, and burned as gaseous bydrocarbons.

Further, the fact that a particular type of oil burner is rated for use with oil fuel of a certain weight does not mean that it will not hamile I ghter grades successfully. If, for instance, you have a burner that properly will burn 28° od, you could use 32° or 35° oil simply by calling in the service man and having the burner adjusted for the lighter oil.

THE grade of oil fuel available Laiso affects, to some extent at least, the type of ignition that can be used. A gas pilot flame will work properly with any oil fuel used in home hosting plants, but electronguistion of the spark coil type is not generally considered actusfactory with oil fuels heavier than 32°, although the electric transformer type of ignition is employed on some burners rated for 28° oil

you buy, the quantity purchased at one time will influence your heating cost for the entire year, because in almost every locably the price of oil for any given grade is lower if you can how in tank wagon lots rather than in smaller quantities that must be measured into a small cellar tank. Over a persod of years this saving may amount to enough to pay for the cost of installing a large

Ande from the grade of all fuel

underground tank.

MOTOR BOATS FARM TRACTORS CRUDE SUTTABLE FOR USE Olio Suitable IN MARIOLO LYPES OF for Home OLL BURNERS FOR Heating HOME HEATING The diagrees shows oths driven off crude petroleum at differ ent stages in the bodfug process. Those totaling to between ONLY FOR USE IN NOUSTR AL 24" and 38" on the OIL BURINERS Brusse ocule are eastable for home heating.

with fuel lower than 36°, while mechanical draft oil burners are listed for oil Juels down as low as 24°. So, while atmospheric humers are cheaper at the outset than mechanical draft burners, the cheaper burner can only be used with the more expensive oil fuel.

The heavier the oil, the harder it is to burn it properly. This explains why a good oil burner has to be something more than a mere plumbers' torch made

Help in Selecting Your Burner

THE Popular Science Institute of Standards has undertaken, in conjunction with The Heating and Ventilating Magazine, a nation-wide survey to determine the efficiency of the several oil burners. This survey is the most claborate of its kind ever made. Oil burners in homes in every part of the United States are being inspected and detailed reports are being compiled.

For information and advice about oil-burning equipment for your home, write to Popular Science Institute of Standards, 250 Fourth Avenue, New York City. A chart has been prepared that will easist you in solving your problem. Ask for it!

NCE you know the grade of a I speci-

for a particular better and have an understanding of the grades of oil fuels, you can get the question of a source of supply quickly settled by topsaring at the oil dealers to your locality. You will probably find that name dealers will quote you a price on the desired grade of oil in the form of a contract to cover your entire winter requirements.

The officials of the Popular Science Institute of Standards will be glad to go into details on any questions relating to of burners and oil fuels. Andress your letter: Popular Science Institute, 250 Fourth Avenue, New York City.

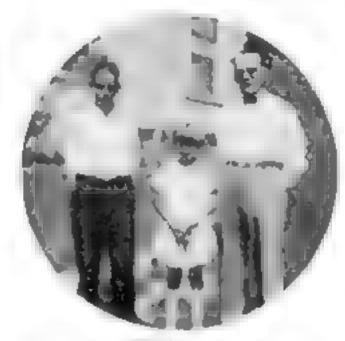
\$1000 More in Prizes Awarded



First Prize

"The home which has been but a dream" now becomes a restory for J C Southwest of Houston, Tesas. Winning the first prize of \$500 in our John and Mary Picture Concest for June, be writes, and make the dream more true. The photograph shows the winner with his wife and baby daughter. At the age of twenty there he is an annation land appearer for a southern endurer." My favorita hobby "he term us, "is to have a hobby." At present he is building the Spenish gallon ship mode which was described in the May and June leases of Posygan, Sciences Mosmitz.

Here Are the Leading Winners in Our June Picture Contest



Third Prize

Persistence enabled E. A. Oliver of Los Angeles. Califto was the third prize of \$50. He had entered each of the previous John and Mary Picture Convents but had fasted to win a price in any of them. The photograph shows Mr. Oliver and his children. He is a draftenson



Second Prize

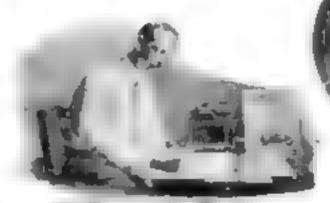
John M. Fisher is shop tracher in the high achool at Los Banus, Capt, was on a camping trip when he received the good news that he had won the second place of \$100. It take great delight in colving problems, scheming and planning to do things other than membry technon," he says. "Even at age of forty nine I can hold my own with my boys."

Others Who Found the Newlyweds' Mistakes



"The pictures of the Newlywods have inspired to to look about our home and discover matches that can be improved upon," writes D. G. Hughes, Babrille, Kana. Above is a sumpshot of "ba"

Herry R Semuction belows is a printing personen in the Government Printing Office at Washington, D C Serious, systematic scarch, be says, was what won lain his prior



"My husband says one of my weaknesses in solving puzzles, writes Mrs. G.F... Rester Be lefothe Pa. Here is the winner with her two sons. Raiph and Robert



A typical wonderson in Duckr Eckbery, who works as cherk as a lamber camp near Ewen. Much. "My one hobby he writes, as unapalton, from which I get many hours of enjoyment."



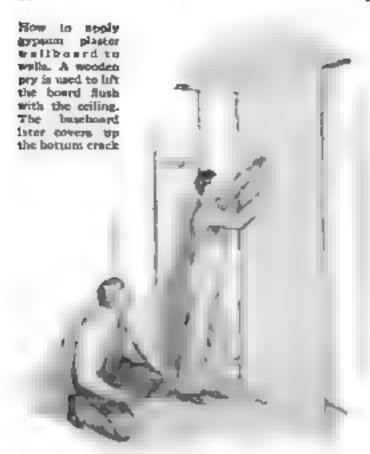
F Paulien, an electrical engineer of Pirtaburgh Pa., with Mrs. Paulien, who be says, "pointed out mistakes the ordinary mass would surely mass."



R. J. Cornell. Jr. runs a duity farm near Venderbit in northern blichigan, For recreation he enjoys skiping and other sports

Nine thousand feet up in the Sucramento Mountains at Clouderoft, New Mesteo, C. K. Caron one of the winners of topiques topiques at the lumber business.

Mrs Philip L. Varney, a fibrarian of St Louis, Mo., tells in the Contest mught her many new and interesting facts



THY fuse about the maide features of a house?

For the same reason that you fines about a proper lining of your coat.

You mean for looks?

That is only one detail, and it coupts too. A good-looking durable lining is needed for a house the same as for a garment. Bearles, the inside finish may add strougth, insulate against heat and cold, improve lighting, discourage vermin and promote clearly seas in homekeeping.

How can the maide fruith add strength? Any material fastened to the maide of stude will stiffen the framework of the hudding and tend to prevent dutortion. If the outside bracing is poor it may be well remodied by the inside earlieing. A rigid wallboard inside is even better than horsontal outside sheathing of boards, which is common cheap practice instead of the diagonal method. To be sure, these remarks apply to wood frame houses, not those built of masonry; yet the strength of the latter, when they have wooden hoors as most do, depends in part on the flooring, an interior detail.

What do visi include under the head

of maide features?

Floors, walls, ceilings and trun. The latter comprises woodwork around doors and windows, baseboards, moldings, panel strips and the like. Of course staircases, built-in forniture, paneling, doors, will dow man and so on are made features but we will leave them out for the present.

SNT tran more ornamental than

That is an idea of those who try to revolutionise the building art. It is similar to the scheme for the abolition of collars and cuffs, which is also based on the mutaken notion that there is no utility beneath the decoration. A baseboard around a room protects plaster or other wall surface from damage by feet, formture and floor mopping. The sloping molding above a baseboard prevents dust from collecting. Trim around a door protects walls and promotes regulty of the opening. Besides these benefits in

Your Questions About

Floors, Walls, Trim and Ceilings

Answered by an expert How to select and use proper materials

By JOHN R. McMaron

the case of a window, tram helps to make an air-tight job and also takes the brunt of rain that sometimes blows in when a sash is open.

What is the least expensive wall auface material to apply?

Wood fiber board. It is practically a beavy cardboard and, like most surfacing of this type, is made in lengths the beight of ordinary

rooms and in widths of thirty-two and forty-eight igehes so that it can be nailed to standard spaced study, which are auxteen inches apart at their centers. Where there is lack of nailing support for ends of fiber board, insert besiders or two-by-four-meh crosspeces between stude. Measure the room carefully so as to obtain the proper ages of the material, which will prevent weste in fitting. Fiber hourd is easily maved. Use shingle nails about five inches apart, fastening to all the atuda.

Can such material be papered?

I TCAN be, after sunng with a glue musture. but the preferred treatment and the one ordinarily recommended by manufacturers as to paint with flat wallpaint, gloss oil paint or coamel. The surface is often paneled in squares with wood atrips two or three mehes wale, which conceal joints and some of the other nail lines. Molding added to the panel strips improves the decomitive effect It is well to give the whole surface a first coat of paint before applying the wood for ish. Better yet, paint the underside of the fiber board before putting it in place: thus

it will be less likely to warp afterwards. Is this material surtable for all walls?

Yes, although it probably finds its widest use in attic ruoms, summer kitchens, summer camps and garages, However, if backed with solid sheathing lumber, the fiber material will serve almost any purpose. There is another sort. of wallboard which belongs in the wood family and is comewhat more rigid than fiber. This consists of glued-together

wooden strips, covered with a treated paper. It may be used in the same manner. as its relative. The cost is a little greater. With this material we must be careful to apply so that the incorporated strips cross study or ceiling beams at right

IS THERE any ready-made planter wall board?

Yes; gypsum wallboard. And we should not confuse this with any of the numerous substitutes for lath or backrage for plaster. Gypsum wallhoard is about half an inch thick, paper covered on both sides, and comes in sections morn-light and four feet wide. When you fill joints and countersunk nail holes with a plastic material, you have a surface that is almost equal to a first-class planter job. Paint or paper as you please. Wood stripping is also used but does not seem appropriate Rigid ty considerable ussulation and fire resistance are the ments

of the gypnum wall-

What are the lath substitutes you men-

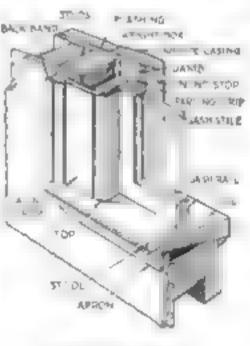
They include the socalled planter boards. usually thirty-two by thirty-aix inches in size, and are intended as a base for plaster. They are sometimes foisted on owners as a suitable final surfacing, for which they are quite disqual.fied by lack of size and thickness. among other reasons.

How amount the new board made of sugar

came fibre?

It is an excellent luse for direct plantering within a house and in also used beneath stucco on the outside of dwellings. About

half an melt in thickness, four feet wide and all lengths required, it combines a high degree of moulation with a strength said to surpass wood sheathing. For interiors it is sometimes finished with cold water paint or, after glue sizing, with oil paint in any culor. When it is to be plastered, either a gypsum or a wood fiber plaster may be used. This byproduct of our sugar bowl deadens sound among its other merits, and it maulates



One Value of Trims

This broken-away drawing shows how the true of a window caring beign to make the window entight, wither tight and weatherproof floors and roofs as well as walls and ceilings. Science has done well to convert this formerly useless substance into a choice building material. A future competitor, we may surmise, will be the similar tough, silicious fiber of cornstalks.

IS THERE a plaster base made of flax? Yes, there is a combination of quitted flax fiber surfaced with wood lath to which plaster may be applied. It is used both for outside starce and interior plaster. Flax is very resistant to decay, ranks high as an insulator, and the lath combination gives surplus strength. The material is in two styles, so as to suit the kind of plaster employed, whether magnesite or Portland, Since the flax-andlath units are smaller than wall-ourd and demand headers between stude, the application requires more labor and extra

Are other substances used for interior Walle

Several, including ashestos in stures, tile board for bathrooms, and a combination of gypsum with wood fiber that is nucle in fall wall one. It is a good thing to examine all the standard products and to be on the kokout for novelties of merit that may arrive on the market at any time. Don't limit your choice between a few materials or take a friend's say-so which may be based on a narrow acquaintance with the available materials. By the same token, ask more than one dealer to show you his line of wares, since few carry the complete stock.

Which is better, wood or metal lath for a job of applied plaster?

Of course metal does not rot, is fireproof and takes less labor to put or being in the form of expanded metal abeets or wire cloth. It shown be well galvamzed The spects obeand weigh about two pounds to the square vand, and the wire cloth should be No. 20 gage with two and one half meshes to the inch. An added advantage of metal is uniformity compared with the eye-measured apacing of individual wood lath. The wood lather is expected to space three eighths inch apart for lime plaster and one fourth inclifor gypsum plaater. Certainly few workmen can make good on a difference so slight, one eighth inch, working at their usual speed. Another point in favor of



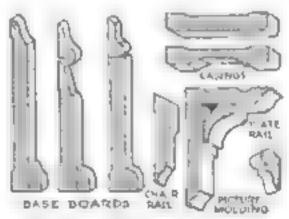
How to Lay a Floor

The entique and grouved top desiring in (ascened by 'bland nations. that is, the mails are driven in just above the longue, the beads being convenied by the impred groove of the next stop of floor Laying the subfloor diagonally arrengthens the house and also permits the top flooring to be laid at right angles to the Snor joists and securely named to each joint metal is that it requires no wetting. an often-neglected essential with wood

How does gypeum compare with lime plaster⁵

Gypsum leads in strength and fire resistance but is more susceptible to moisture. Lame may be fortified to equal strength with Portland cement. Linie and gypenin may be combined half and half, anmetimes plaster of Para is an ingredient. If in doubt of local tal ent, buy as approved ready-mixed plaster which only needs mosture to apply. Instead of the customary two

conts, a single cont of nich plaster five eighths of an inch thick will do very well. If you want to be quite fireproof and rodeat-proof, use only Portland cement and mad, one part of the former to two and one-half parts of the latter, on metallath. This is similar to an exterior stucco



Caeful As Well As Ornamental

Several kinds and styles of molding. Be uides making the room attentive they protect the walls and facil tate cleaning

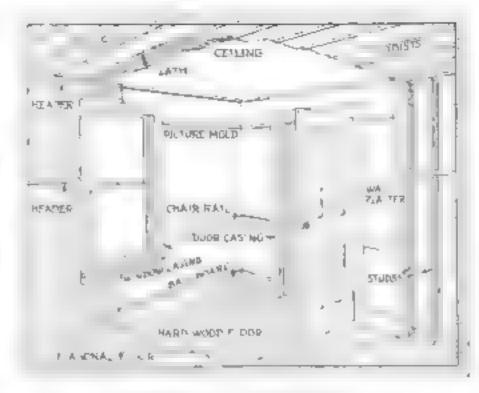
maxinee. The mason is likely to protest that he never heard of such a thing and it can't be done. Doubtless the material is not easy to work, it sets rapidly and must be made in small batches. The color objection is obviated by the use of white Portland cement.

SICH a wall would amount to retu-

Practically so. However, I do not advise this or any other departure from accepted methods where workers lack intelligence or cannot be personally supervised. To do anything a new way usually takes more effort and costs more. Contractors as well as mechanics are hostile to change. A fair performance in old routine is better than superior methods with botched results. When building in Egypt, let the fellahin carry wheelbarrows on their heads.

Should plastering be done before or after the floor is had?

Before the top flooring is laid, so as to save this from ground-in dirt and warping due to moisture. When plastering an old house, protect the floor with plenty of



The Lining of a Well-Built Home

Typecal methods of substantial interior countraction, with various unity of construction indicated by name. Not only the appearance but the strength of a house depends much on its interior lining

> building paper. Give plaster two or three weeks to dry before moving into the dwelling; allow more time before decorating or paperbanging.

> TS THERE any real advantage in laying

a subfluor diagonally?

Yes. It braces the whole house as well as the floor. As when you strengthen the bottom of a box you stiffen the entire box. It she permute the top flooring to be land at right angles to floor joints and securely nailed to each joist. When the airbfloor is at right angles to joists, either the top will must be underlying post hold or, paralleling the lengthwise grain of the boards below, will lose the strength of crossed fibers; not to mention the frequent meeting of joints, top and bottom, in the latter case. The extra labor cost of the dugonal method is a trifle compared with the advantage of general strength and a rigid, equentiess, unwarpsig flour. For the robfloor you can use any common square-edged inch bourds, including lumber that has been used for the foundation forms. However, these boards should be well nades smoothed to a uniform flat surface and covered with damp-proof building paper. Instead of paper we may use a layer of heavier insulating material, especially where there is no cellar beneath or when we wish to deaden sound, as from an electric pump or oil-burning furance with motor

What is the cost of top flooring in various words*

That depends on grade, thickness, whether quarter sawed or plain, also on with of meres, made the narrower widths have more footage-consuming joints for which the customer pays. For ordinary widths you must allow one quarter to one third above the room area, while it takes fifty percent more for a one and one-half inch width of face. That is, a room of 100 square feet actual use will consume 125 paid-for square feet on the ordinary width basis, but the narrow face will consume 150 feet. Some of the unseen footage is due to tongueand groove matching and the rest is traditional toll to (Continued on page 150)

Queer Pranks the Moon Plays

Why you lose weight when it is overhead-How monkeys talk-What an athlete should be able to do, and other fascinating stories from new books

By THOMAS M. JOHNSON

"Astronomy Today"

By the Abbi Th. Morens. Published by R. P. Dutton and Co.

THEN the moon passes vertically overhead, did you ever notice that you lost weight? Well, you do, the Abbé Moreux, noted French astronomer, says. A man weighing 1681 po pada weighs 1 3400th of an ounce less Lister the moon

It is the same influence that causes the tides, perhaps the best known comple of the moon's medding in our affors. Here

is what happens to make the tides, as the Abbé teds it in his fascinating new book.

If the water keeps weight when the mosois overhead, the column of water threetly under the moon must be higher than in other parts in order that the pressure on the sea floor may renath the same and equilibrang be maintained. This bulging outward of the occupie surface of the tide.

Now, here is an odd thing. When the moon passes straight over New York, for instance, not omy are the tides the same in exactly the opposite part of the earth. but the other magnetic

effects likewise. At the same time that we lose that 1/3200th of an ounce, so do the Chinese on the other side of the

The earth may be eighty-one times the rige of the moon, but that does not menu. we can look upon it with contempt, arcarding to the Abbé. The moon pulls us in their and you, working sometimes with, sometimes against, the min. The effects depend upon the position it occupies in the beavens. A thin, sickle-shaped new moon hasn't much attraction except for popular song writers, and simply works with the sun. When it gets full, it gets independent and pulls in the opposite direction.

THE more he has studied the moon, I the more things on this earth the Abbé has found it mixed up with. For instance, gardeners who now certain piants "in the dark of the moon" or when it is full, according to the effects they wish to obtain, may not be merely perpetcating come old borus-porus after all, he declares. He thinks the moon's action is really effective in increasing the see of plant cells. Cryptogamous plants,

for example, those that have no flowers and propagate by spores, acem to grow best during the full moon. This is said to be especially noticeable in the tropics.

The Abhe's theory of "the creation" is sisteresting:

"I conceive the entire universe to be enclosed within a spherical space, through which at first all existing matter was spread. As the result of some process of which at present we have no conception, these nuterials came to be collected in the equatorial none of this enormous sphere, and by their evolution gave birth

their maximum speed, at the end of that time the surplane would be 612 miles out in the Pacific occan and its nearest competitor, the racing automobile, would he in El Paso. Where the others would be is shown in the accompanying diagram.

Greatest of all wonders of the air pa the rapidity of its conquest, decisies Major Arnold in Airmen and Aircraft The first aculance flight on December 17, 1903, insted twelve seconds and west 120 feet. The muchoe had first to scoot along a wooden track to get started, with Wilbur Wright helping to balance it. His

> beother, Orville, piloted All lying on his stomach in the center.

Compare that first flight with the recent \$500-nule mountop record of two daring French aviators and you will redme comething of aviation's awift progress.

"The Pedigree of

the Human Race' By Harris Heavthorne

H slace Published by Henry Halt & Co.

DID you ever wait a

zoo and hear a

A Fantsatic Ruce If we could imagine a race across the continent by man a chief means of creek-country locamotics week or measurement speed and starting from New York-the result would be anosething libe the have-up shown here—the plane out in the Pacific!

gibbon making strange noises while he ate? What was he saying? Well, the odds are that st was something like this: "Hoe hooe hee! Hee

hore hore! Gennegae! Connact Hog!" That is the gibbon a way of expressing satisfaction.

But suppose another gibbon upproaches, with hungry eyes on the remains of the poundt. Here is what the first gibbon will say:

Thurning! Hoseougig! Koubig!

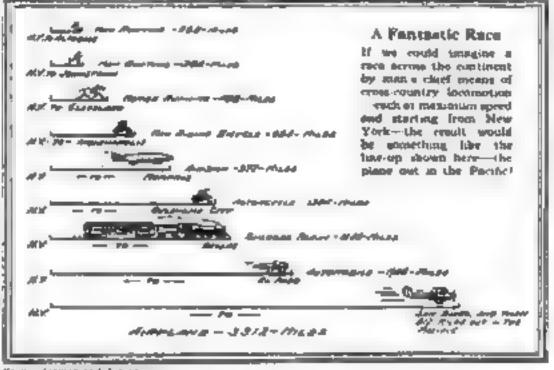
That means be is suspicious of that other fellow and is getting worried.

The second gubbon jumps for the peanut, there is a struggie, and the pennet falls. Now hear our friend register emphatic disgust.

"Hoe hooue, koe! Koughig! Crueg!"

THAT is monkey talk, according to a scientist who should know. He is a Frenchman, M. Boutan, who for some time studied the actions and cries of a captive gibbon taken from its mother almost at birth, and reared in a French garden away from all other monkeys and so with no chance to pick up the language from its own kind,

The observations showed a "language" capable of expensing satisfaction, an interracellate state, ([outround on page 167)



to stars, stellar systems, our own sunin a word, to all objects which constitate our Milky Way, properly so-called. But this, it cannot be doubted, still includes portions which are not yet condensed clouds of gas or of meteors, and these give rise to the apparently empty spaces in the Milky Way itself or around the stars and the galactic nebulac."

"Airmen and Aircraft"

By Henry H. Arnold, U. S. A. Published by the Renald Press Company

STPPOSE that, to test man's chief means of locomotion over land, we held a great cross-country run from New York westward, each method at its maximum speed. The line-up, according to Major Arnold, could be shown by a table

Land No.				
Мар топров	Hate	. 21	priles an bour	
Man Skatting	wh	22		
Horse rounter	0.0	39		
Man riding beyole		37	41	
Atrobio	-	261	hap	
Matampole	46	112	-	
Rulewed True	Pris	190	-	
Automobile		163	-	
A Strolle ton	91	278	44	

If the contestants all kept going for twelve hours and were able to maintain

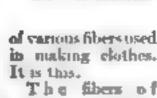
New Chapters in Air Progress



The an expert is dying comfort and safety for passengers to fraud in the design of the newest and largest of Paymon, a commer all acroismes the riple engined. Assume The presence of the Intgerms Assume. The presence of the above as the right passengers and their higgage is above as the right. The designers daint the great lines on thy level of any une of the orse engines at a special of 115 (piece in these une of the orse engines at a special of 115 (piece in these une of the orse engines at a special of 115 (piece in these une of the orse engines at a special of 115 (piece in these units of 115).

Science Finds a New

It Turns Sawdust to Sugar and



The fibers of eloth, especially wood fibers, absorb moisture. When a hot iron is applied to the cloth it produces a crease by bending the fibers artificially at a sharp angle; but at the same time the beat dries the fibers as

that they remain in their heat position, monthoong the crease for some time.

When the fibers get damp again, in wet weather or through persperation, they absorbs little water and swell slightly, at the same time returning to their usual

On these pages are presented early month. brief stories of scient tie discovery and research having practical bearing on our eseryday problems.

straight or wavy form. The artificial kink produced by the hot trop disappears and the crease vanishes.

Chemist's Amazing Experiment Turns Sawdust to Sugar

FEW years ago a German scientist nade the prediction that eventually men, after reading their morning papers, would be able to treat the paper with chemicals and out it, using as food the woody material contained in the news-

I olay that strange forecast is near to coming true. In a recent report to the Society of Chemical Industry in England,

Dr. W. R. Ormandy announced the perfection of a remarkable new chemical process for converting dry sawdust into a mixture of sugars, by treatment with hydrochloric acid. One of the sugars is said to be orditury glucose, or com sugar, a substance surtable for human foul.

Thu discovery in regarded by other scientists as aigmficant in view of the often repeated fears that the world is facing a critical food shortage.

How the Lower Animals Make Love

SOME remarkable methods of wooing practiced by anders, worms, bugs and birds were revesied recently by the noted British

anturalist, Julian Huxley. in place of a diamond or a box of chocolates, the male hor ting spiner has been known to entry to his ladylave a luseious fly wrapped in silk.

Certain manne bristleworms stage puptial dances in the mooil ght. Swimming out of their crannes in the rocks,



Blue Diamonds from Yellow Dr. C. E. Field, of New York, has been amazing jewelers by transforming yellow disastends into blue genus of apparently first water. He concentrates radium rays on the stones, thus them cettly altering the color. Here Dr Field is shown applying Indiana to a perce of willesmite

been discovered by the use of an enserical "divining red." The new electrical method of prespecting which is said to have

He Predicts Homes Made of Quartz

People will some live in glass houses but not transparent open, says. Walter G. Wolf moted chemist. Pured quarter can now be made taxo

building blocks, and such bouses would be unusually healthful to her m,

he says, for they would permit pussage of the health giving ultra-violet rays of the sun. He is shown here at work in his Boston ishoretary

Electricity May Locate Gold in

Your Back Yard

Your nack yard roight be found

to hide a gold deposit by this new

method, for, while most see on the

surface of the earth has been do-

covered long ago, the new electrical

method has located over at places

where their presence could not pus-

addy have been predicted by any

for example, that in the Swedish province of Vesterhotten, near the

Arctic Circle, a gold ore deposit has

Word has come from Stockholm,

other known method.

resulted in the find was developed by Hans Lundberg and Karl Sundberg, two Swedish maning engineers.

An electrical field, paradel with the earth's surface, is set up underground. Delicate instruments chart this field, do tecting disturbances pronuced by the electrical properties of the ores. This makes it possible to locate the ores.

Small Earthquakes Protect Us

INSTEAD of regarding small carthquakes as a danger, we reshy should be thankful for them, mys Professor Richard Swann Lull, of Yale University, who says such quakes act as safely valves, relieving strains in the earth's crust.

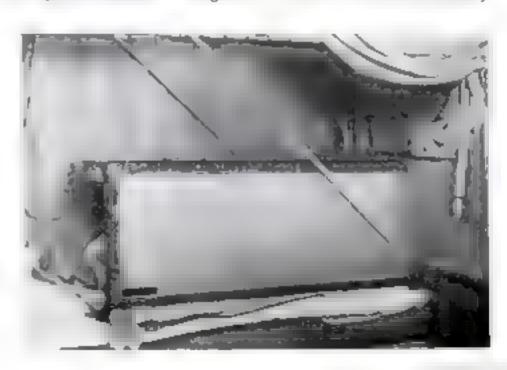
These strains are arising continually. explains Professor Lull, owing perhaps to the attraction of the sun or moon. A series of small breaks, he concludes, is much safer than a long period of quiet followed by a much more violent break.

Why Trouser Creases Don't Stay

WHY won't trousers stay creased? Every man asks this question when he sends them to the tailor, and a scientific explanation has now been given by the British textile industry, which recently made investigations into the behavior

His Electric Bed Prevents Colds, He Says

If you are susceptible to colds and impdred adments, mys Profespar Malton Phirchild, of Chevy Ckeer, near Weshington, why not try therpang in an electric bed? Professor Parchild humorif skeeps in one, as shown at the right. He regulates the heat rays according to the weather, and declares the effect of detect exposure to the electric rays is highly beneficial to the system



Job Every Day

Yellow Diamonds to Blue

they gather in groups, the males dancing about the femples.

In the world of fiddler crabs, the male strikes a statuesque pose whenever a gentle lady passes by. Starding on tiptue, he raises a large, brilliant claw rightly paoft. If the female pays no attention, be come to where she can see him and repeats the pose.

Some Webser rang spaders, when they rall on the females, at no one, their preval by vibrating a thread of the female's web to give notice of their friendliness

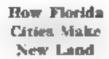
Sir Jagadia Offers New Tests to Prove Plant Heartbeats

N HIS way to one of the recent Oxford necessar of the British Assorigt on for the Assumement of Science, S.r Jagastis Chandra Bose, noted Indunplant psychologue, plucked a common anapdragon by the roadsule. n or ites later, with marvewasly demonte austroppents of his own design, he revealed to an astonishen andience what he deplaced was the neart of the point beating. and the wood of the point flowing.

Placing the inapilragin on a traville showed how his instruments recorded its "heart pulsations, the record being in the form of tries on a sensitized plate. He revealed, too, how the insversent of the map or "bloos" of the plant was affected

by drugs or passons.

New piscoveries industing the anni-Inrity between the lives of plants and human existence were described in the August Popular Science Monthly, Sir Jagades latest experiments have aroused world wide interest, and if fully substan-



If this etrolene photoof St. Augustone, Fla., had been taken a year ago, it wouldn't have shown so island out in the bay! In this abort time 13, 000.000 culsa yarda of und were dredayd up to make the mand. attents were said out. and the bridge built



tinted will revolutions so our ideas of the growing thir gs about us. Most American scientists, however, have expressed strong disagreement with the Indian savant's interpretation of his experiments.

How Your Nervous System May Break Down

WE HEAR much about our 'nery ous systems these days without understanding, except in a vague way, what it is all about. It has remained for Dr. Wilfred Trotter, of the University College of London, to offer an easy-tograsp explanation.

The nervous system, he says, is like the electric wiring in our houses. All the perves which reach out from the brain to the various parts of the body are moulated from other bodds trasses as carefully as house woring is insulated by the electri-

When this insulation breaks down we soffer pain, says Dr. Trotter, past as a break in electrical insulation may start a

> fire. Thus, when a perve to out so that its fibers touch other tusies, we feel the pang of the contact. One of the most painful of all sicknesses results from the general breakdown of this mesulation of the perves.

LOX - Mightier Than Dynamite

BOI T fifty years ago a A French screntzst, Louis Paul Cuilletet, while working us his laboratory madvertently opened the wrong valve in an apparatus with which he was experimenting. Hw mistake made secentair history.

In a glass tube which was part of the apparatus, he observed a drop of mouture. He knew at once that he had found a way to reduce gases to liquid form.

This discovery was liquid oxygen, which since that time has been developed into an explosive more powerful than dynamite, yet cheaper and less hazardous. In tests recently conducted by the United States Bureau of Miner, liquid oxygen explosive, or LOX, was found particularly useful ru blasting rock. The danger from accidental explosion is reduced, since the liquid overgen cartra gen cannot be set off except by a severe shock. A truck full of lightly oxygen cartridges, it was man, rould be drawing through the affects of a city with little frac of exposuon,

The explosive is made by mixing earbour

with the laguid oxygen.

Thought Tests to Recall Our Babyhood Memories?

Wi'll plenty of patience, paper and a per oil, it is possible for year to remember what happened when you were see months and declares Dr. E. Pickworth Farrow English psychologist,

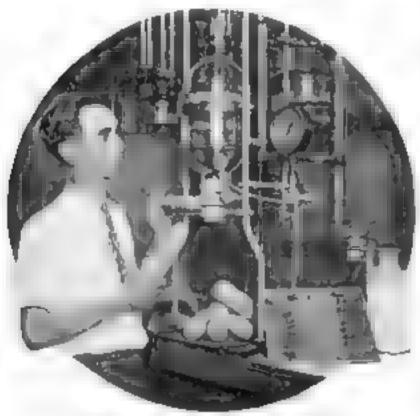
bur periods of one or two hours at a time, he says, write down any and every thought which occurs to you. Repeat the process several times. Then as memories of recent happenings gradually are "worked off" on paper, you will go buck to recallections of your early afer

Rain As a Soil Fertilizer

AFTER all, there is a pot of gold at the end of every rambow, at least for the farmer Dr. Frank T. Skutt, chemist of the Canadian Department of Agriculture, has just informed us that rain and snow not only water the fields but actually fortifize the son. They wash down out of the air and into the earth enough nitrogen and other aubstances, he says, to make a real difference in the farmer's fertilizer ball, an the vicinity of thinwa. The amesint annually washed down is equivnient to forty-four pounds of expensive Chile auttpeter per acre.

Bald Heads Brainler, He Says

MORE cheer for bald headed men comes from Dr. H. J. Fleure, British anthropologist, "It is not far wrong," he says, "to assume that demumbed hair growth liberates thyroid secretions to exert themselves elsewhere. The relation of thyroid to brain growth is close also; thus diminishing beir growth becomes a factor in brain growth.



Corn Another New Source of Sugar

Twenty-two pounds of sugar from one bushel of corn! That as said to be the remarkable result chements of the Department of Agriculture are getting, with the apparatus above. In the picture W. F. Hemberger of the department is shown adjusting the vacuum apparatus that extracts the sugar content of the corn. Samples of candy made from the engar are also shown

Athletes Choose Sports by Novel Tests



"WHAT, you play tenne? No wonder you are a third-rater, my friend. My examination and appliances show positively that you are ideally equipped for weight-throwing!" So declares Dr A. Thooris, president of the scientific commission of the French Athletic Fielderation, to the aspiral gathlete who rugnes to him for guidance as to the branch of athletics in which he can excel. Following this advice, if he wishes, the tenne player their proceeds to become a champion, hammer thrower, or a shot putter

Why does many an attacte of ideal physique generally lag behind in his chosen aport? How can be find out in which branch he can become first-rate?

Dr. Theoris conducts tests to answer these questions in his laboratory in Paris. Here, succonsided by charts, anatomical drawings and queer mechanical apphances, he recently examined more than a hundred French athletes.

All men, he says, can be classified into four types. These are the "respiratory, The "pneumograph." It registers varying chast movements for short and long breaths

in which the thorax, or chest, predeminates, the "digestive in which the abdomen is predominant, the "muscular typified by well-steveloped chest and the "cerebral," in which the head is pronument, the body under sleveloped

There are several combinations under this classification which is subordinated to two more general classes, called by Dr. Thooris the rounds and "flats." Carpentier, the French boxer, is a "flat" Dempsey, the heavyweight, is in the opposite class, muscular, rough; ideally built also for broncho-busing, football, six-day beyels racing. These two men have found their mediums, and therefore they are superior.

The greatest handicap under which folly thirty-three percent of athletes labor. Dr. Thooris has found, is built breathing because of nasid obstructions. This facit he treats by disstolization," or gradual opening of the masal passage.

Among the unional testing devices which he has invented in an "oscillometer, to test blood pressure and the atheres staying abuttes. The subject is tested after exercise with damb-bells, and classified according to the time required for the blood pressure to return to normal.

The "pneumograph," another device, is a pneumatic gralle which registers the movement of the chest mainten in in-halation and exhibition.

Free-Bottom Speed Boat Skims Lightly Over Obstructions

An Jowa Man a Ingenious Idea

These side and rear views above bore the huilder new sig a broad stero to mount steering and driving apparatus, schieved a stream labe effect. ExtIRELY free-bottomed some requestly capable of skinning over the water with extraordinary light ross the some speed and constructed by Thomas Purvear, of Chuton, lower somewhat on the order of a hydroplane,

The role routing of energy and power apparates made the char or their possible for each case of the their propeller a regulation surpose type. In stead of the submerged rudder, this boat has an arresaft tail and fine adder



Animals Get Toothaches Too

Zoo Doctors Must Use Wiles to Treat Their Ailments

A more throat to a pelicus as no minor althout, wrong that there a so much more throat to feel sore. No avaider he objects to taking medicine



Toddy. New York beby elephant, having a tooth extracted an operation requiring aprend dent at a took. Left Rangement beby attached which broke a tooth on a rock

WHEN the doctor gets a call to the zoo, he must take with him a bag of tricks quite equal to that of a stage manual.

When I mustance, Teddy, the New York Zon's entry of phant, was suffering from a toolastic, the doctor needed several associants in extracting the anolar, which was almost the mass of a golf half. And as for this budy alogator at the London Zoo, which broke a tooth in pilling its strength against a rock,—the actual extraction was cased than overcoming its strength objections.

The periosa or the illustration had a nore throat, and waste it spened to mouth quite willingly to receive the dose, change the pawe and awallowing were another matter. The attendant finally had to map the hill shut and hold it that way forcibly until the medicine ran down.

Climbing Feats of Wheeled Tractor Amaze Engineers

Tills consent hors power for which concolor designal as for the regiments of
color at a contract of regiments per government. I be receptly by its program of
contract of the log of contract of the recommendate as an all of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the log of the log of the
contract of the
contract of the log of the
contract of

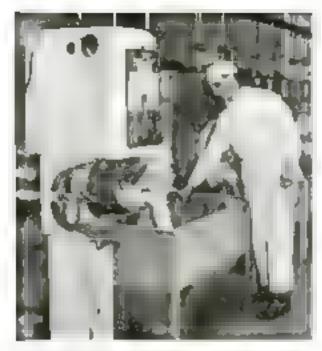
a spin of the hole of spins to be presentable for the few to be spine, from the best to a rest, the attract to be the best to be spine, the attract to be spine, the attract to be spine, the attract to be spine, the best to be spine, the best





A Remarkable Performance

One of the most priking fepts of the new cases on in or as ing attention, wherein submerged filter firsted in the pritiare of he left of a tau ing a gain. Even more remarkable in the cases many feat particular above demonstrating he cases many adjustment of the four whether in any plus pase the transfer or a microcal plus for (canaparation me over my andeveloped country)



Ice Cream Making Automatic from Start to Finish

BY THE adoption of standardized processes and machinery number to that shown in the illustration above, big ice cream plants within the last few years have attained the highest degree of samilation in the preparing of the great American delicacy. At no time is the see cream touchest by human hands

The picture shows a hattery of freciers, which convert the ingredients into a partly frozen product. The macture flows into this machine through chilled aliver tubes from large storage tanks which receive the warm ingredients. The hardgoing process is not completed noted the partly frozen maxture is discharged from these freezers through chotes to the floor below, where it is packed into ears or tracks and placed for fine hardening in the freezing room, where a subzero temperature is manufacted.

The freezer is equipped with an automatic meaning device which regulates the flow to person packing into cans of the desired content. The process maintenance from start to fluish.

Asbestos Suits Guard Smelters from Fire

THE natty out at the left represents the latest style hint for anchers. It is made of asbestos cloth, for these men are constantly exposed to the danger of having their clothes set after

A practical feature of the suit is that, while affording absolute proto-tem against fire, the cloth is flexible and does not impede free movement. It was shown at the last Foundry Trades Exhibitional Islangton, Eng-

"What well-dressed

A 22-Mile Pipe in One Piece

THE California town of Vailejo is now being supplied with water from a distant reservoir through a one-piece pipe twenty-two miles long. The parts of this remarkable pipe were made into one piece by are welding instead of riveting.

Shuttleless Looms May Revolutionize Weaving

SHITTLES have been so essential a part of weaving since weaving was first thought of, that the many attempts of inventors to device a shuttleless boun have seemed foredoomed to failure. Now, at last, the thing has been done.

An ingentatis device for weaving, with the shuttles replaced by a wax cylinder somewhat like those used on the old talking maclimes, was exhibited at the last Leipsic Fair in termany. It is expected to revolutionize weaving

The design to be woven it projected on a glass plate, from which it is transferred to the wax cylinder by a photo-electric process. The depth of the groove in the cylinder guides the weaving device. Each cylinder is grooved with a single design.

He Carves Ivory Masterpieces from Walrus Tusks

MOST curvers have to content themselves with wood or marise for material, but H. C. Hencock, of San Fran-



The fragile looking object the girl is holding in a stamp stall curved from walras tustes

cases, uses ivory. He used to live in Alaska, where walrus turks are plentiful. Out of these he has carved over 500 pieces.

Has masterpiece in the little model shown above, made to scale, of a stamp null in Treadwell, Alaska. Even a figure of the operator is included.



Combination Smoking Set Even Puts Out Lighted Stubs

ALL that the smoker could ask for is a combined in the single ingenious smoking set above. The upper compartment, which has a hinged lid, contains two removable trays for eigers, a partrioned section for eigerettes and a space for a match box. The tray serves for ashes and as a rest for lighted eigers

The drawer underweath is divided into three compartments. The center one is filled with water and as the trays for eigensteened eigens have perforated buttoms, the moosture keeps the smokes from drying out. The two smaller compartments receive the burning stabs.

Electricity Now Refines Honey

AFTER several experiments to find a better way to refine stra ned honey, a California firm has fit upon the apparation of electric heat. The old method was to place the time in a water trough and heat the trough with gut burners.

The new refiring process consists of placing the timed honey which is write and thick before treatment in a compartment insolated with cork. The honey is then subjected to a temperature of 130 degrees for two days and nights, after which it is clear and entirely liquid. Ten electric air-heating units mounted on the bottom of the compartment are controlled by a magnetic switch to prevent the honey from overleating, which would darken it and spirit the flavor.

It's the World's Biggest Passenger Locomotive

THE two locumptives below persent a striking exhibition of the trememous advance in locomotive construction in the last thirty five years. The big one is the largest passenger engine in the world completed recently in Baltimore, Md. for an eastern railway. The little engine was

built in 1800—it was a giant at that time.
Only there working days were required to put together the mights modern engine. It was designed to hand twelve passenger coaches over heavy graves, channating the need for "posher" engines. With its

tender it weighs more than 320 tons.



The only becompaire in the world that can haul twelve passenger can over steep mountain grades. This giant was built for service between West Virginia. Washington and Pittsburgh



House Painter Turned Artist Still Uses Old Medium

PAINTING houses in his native fown of Woods Hile, Main, was not enough for Franklin Lewis Gifford, so he spent his lessure hours in applying paints to canvas. So adept has he become that now, in his seventy second year, he is recognized as an authority on scancapes and historical pictures, and several of his paintings have been exhibited in metropolitan galleries.

Mr Geford sticks firmly to the medium with which he started out. He uses common house paint on his canvases, and his

palette in a nommon board.

It, his early manhood he was captain of a fishing schooler, so he is well able to give his maxines a tone of authority.

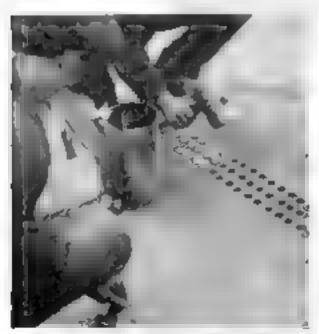
Odd Bullet Leaves Fiery Path

TO EXABLE machine goiners to correct their non-by making it possible for them to I llow the flight of their hallets to the target, the ordinance department of the United States Army has rievised a projectile which etches a redhale in the sky, 1200 yards long, in the path of flight. It will be of special importance, it is mid, to airplanes, which have had to estimate the range and direction of fire without seeing by how much they were among their target.

A chemical composition in the base of the builet, set after as the builet leaves the muzzle, gives the desired effect. The red color was found to be more visible against

the sky tuan other colors.

The new projectile will also be useful in anti-aircraft guns for ign trop enemy balloons and other inflammable objects.

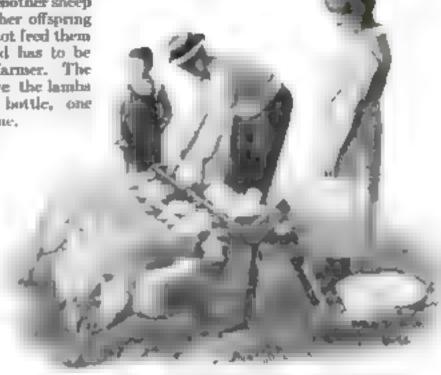


Hammering new porcelain traffic markings in a Loudon street. Holes are drilled first

"Mechanical Mother" Nurses Lambs

NOT infrequently a mother sheep refuses to care for her offspring or, in case of twins, cannot feed them both, so feeding by hand has to be done by every sheep farmer. The usual method is to give the lambs hulk from a nursing bottle, one lamb being fed at a time.

An Iowa sheep raiser however had devised a mechanical feeder which feeds ten lambs at once. It is a wooden trough with a row of holes. bored along the botform at st large emough so that the necks of hottles can be in serted. The bottles of malk are placed in these boles at au angle so that the malk will flow slowly



Ten tembe at once are lod with soils by this ingenious feeder, invented by an fews above raiser. Before questing bottles are used



Lorgest copper crystal, weighing twelve pounds. It has revenied strange properties

Mechanic Invents Flying Bike

A FTER several years of experiment, a voring French mechanic has invented a breyele which, it is reported, can be transformed into a small monoplane and its to a height of 150 feet. The inventor believes that the successful manufacture of his fixing breyele in large quantities will bring flying within the means of all.

Now-Porcelain Traffic Marks

ONDON is solving one traffic problem

- the peressity for frequently repair ting white read base, by making the marks on the asphalt permanent. Into holes drilled into the pavement short steel tubes are placed, and into each of these a white porcelain button is glued. The buttons are accured firmly with bitumen

These porcelain markings, it is said, have the advantage of not wearing off, like point, and after rain look even brighter and whiter. Moreover, the purcelain buttons are easily replaced.

A countrarion portable outfit supplying current for are welding and compressed air for running drills, grinders and chipping hammers, is the newest thing for field work. It is driven by a gas engine.

An Amazing Piece of Copper

SHOWN at the left is the largest angle copper crystal in the world. From an ordinary piece of copper it was reduced to its present form by terrific heat, which rearranged the chaotic atoms in orderly form. The experiment was one of several made in the laboratories of the General Electric Company to discover the latent properties of single-crystal include.

In its new form, the copper was found to conduct electricity therein percent more efficiently than before. Aso, it bends cools, but only once. Bending

matters the atoms again.

Her Market Basket's on Wheels

NASH and pull " in → better than "cash." and carry," a Detroit woman believed. and so she invented this market basket on wheels. A peck of polatoes, a #4-pound anck of flour a miseycent loaves of bread shipped into it, can be pulled home wells little effort. The base ket is light enough to carry when empty No more eching arms when this bousewife

No more schang arms when this bousewife comes borne from murket thenks to her handy attractive banket curt

Radio Controls New Fog Signal

THE Marconi Company in London recently announced the perfection of a wireless-controlled fug aignal for use in inaccessible places, or where it is too expensive to maintain lighthouses. The apparatus is controlled from a central station, where a keeper sends out wireless impulses to start a gun ficing at intervals. It is stopped by another set of impulses.



Ingenious Magnetic Apparatus Counts Drops of Liquid

WHERE liquids must be measured in drops and one drop makes a tremendous difference, there must be great accuracy in courting. For laboratories and other places where chemicals are measured, the new magnetic counter a rove has been devised.

It counts drops, recording them mecharically. As each drop hits between two halls placed below the spout of the container, the water completes an electrical circuit and the drop is recorded.

Huge Ball Tells Time by Flashes

O's TOP of a large office building now herog built in New York City there is to be mounted a amount clock. Instead of hands on a real, it will consist of a huge globe nineteen feet in character constructed of curved sections of glass held together by metal strips. High power lamps will keep the whole globe illuminated with a stendy white light, except on the hours and quarter hours, when it will flash once with a red light for each quarter of an hour that has passed. At twelve moon the whote light will be flashed on and off twelve times.

A Dream of Inventors Realized

THE manufacture of metal tubes and sheets by a new electroplating process was described recently by Dr. William Blum, of the U. S. Bureau of Sanatards.

The advantage of making metal shapes in this way lies in the fact that the most complicated forms are easy to make, and, unlike the rolling and drawing processes, the thinner walled pieces are cheaper to make than the heavy ones. The method explained by Dr. Blum, has developed slowly because of the difficulty of griting impervious deposits and uniform distribution of the metal.

Magnets Clear Roads of Iron Refuse

IN ORDER to cut down the chances of punctures to automobile tires, the highway department of the State of Washington has constructed a special road machine twenty-five feet wide fitted with twenty-four electromagnets, each with a lifting power of twenty-four pounds. On payed roads the magnets are held about two inches above the surface as the machine moves along, and on gravel roads they are lowered to stir up the roadbed slightly

On a recent 50-mile trip, the machine picked up eighty-seven different articles, consisting of nails, bolts, tacks, pieces of wire and other miscellaneous scrap from

Trick Music Box Hides Smokes

BELOW is shown the latest contribution of Paris to the world of music—a musical smoking set. Lifting the box of matches from the stand releases a wire which starts the music. Replacing the match box in front of the musicure juzz band stops it again.



A Hobbyhorse with a Real Thrill-It Walks

GIDDAP, horse! Let's go" The amazing tong about this new that it really obeys and walks. Instead of merely a walks, instead of merely a walks, it goes forward by a tattachments on its four feet, as the constant weight.



The metch box, placed on the etend, stops the muse removing it starts the tenking etreins

New Cutting Torch

A SPECIAL metal-entdevised by an eastern company in which manufactured gas replaces accty one hydrogen and other expensive gases usually used in such torches. Besides its eximparative el capitess, other advaninges of the manufact reslgas torch are said to be its greater availability and safety to the user

Traffic Cops' Car Equipped with Loudspeakers Ust ally the motorist

by the cop for infraction a traffic ride can take condort in the fact that at least passers-by are not hearing the verbal lasting. Now the Detroit police have taken away even this comfort by mounting landspeakers controlled by a incresphone on one of their autos, for den-

This scian cruses about the city and when a motorist is observed doing what he should not do, the poberman in the sedan gives him a lecture that can be beard a block away.



If you are caught violating a traffic rule in Detvoit, a cop in this loudspeaker equipped auto may deliver suplement remarks that the whole block can hear. The car is also used for "safety talks"

the players with ready made term

Replacing a a n d beam and a s n d tees, this butfit, enstalled on such see, would growide

Automatic Golf Tee Outfita May Replace Sand Boxes

Two of the latest accessores for golf are these artificial tees and tee boxes, which the inventor claims will save at least ten minutes for each foursome on an 18-hole course, besider avoiding congestion on popular courses, by doings way with the necessity for building individual sand tees at every hole. The tees are conschaped, with serrated bottom edges to grip the turf firmly without upsetting. They are of regulation height, grassgreen in color.

The box holds 900 of the tees, which are placed on the seven spinitles mode. The stand has a frame on each side for golf-hag rests, two in each frame and a hook on which to hang a refuse pail. With this outfit, of course, sand boxes at every hote are superbloom.

Losnox district guardsmen no longer saidte to the snappy accompaniment of heel-cheking. By a new ruling, they wear rubber beels to case the jar of marching.

New Shoes Protect the Athlete's Heel

Finding that he could not wear the ordinary spiked abor for all field events without changing his footgear for each event. Charle Brookins of Iowa I siversity, a low-hardle record holder, made out his own specifications and had this sample pair, shown in the picture, made for hou.

They differ cheefy from other track shoes in the construction of the beel, which contains a stiff counter of leather on each side, affording support lacking, he says, in other light above. On the inside of the heel is a sponge-rubber pad, removable and renewable. The athlete can wear these shoes for running, hurding and jumping, Brookins says.

Liquid Tar-Our Newest Fuel

LOI ID TAR assaultahave found a new mass recently put through the test of heating a Rochester, N. Y., plant for an entire season. This company new produces about 15,000 gallinas of it andy



The sole of the above to applied as usual, but stoff leather counters and subber pade less the heel and afford support

Moss that gathered in the spray ponds and clogged apparatus in a indi-western power house was a real source of trouble, note the manager but upon the idea of putting goldish in the ponds. The moss is now quickly exten by the fish,



Filling the teak from one of the medade trought Cautheria provides on the Ridge Route. As an added convenience telephone face has have also been untailed

Water Troughs for Thirsty Autoe

WATERING
troughs were good
enough for Dobbon, why
not for his foor-wheeled
successor? Cabforous,
considerate of the thresty
flever and its more
anatografic relations, is
building troughs like the
one abstrated along
some loghways.

Secreta of the Big German Guns

THOSE mysterious long-range German gons which bombarded Paris from a distance of more than sixty miles

during the war were actually the monsters we pictured them to be. Some of the secrets of these manmoth weapons, closely guarded even after the Armistice, have now been revealed following the death of their inventor, Dr. Fritz Rausenberger of the Krupp works.

The gums were about 138 feet long, and each weighed 1.4 tons. They fired 8.3 inch shells, each weigning 220 pounds.

To obtain the entriums range, the gunt were fired at an elevation of fifty degrees. The charge for the longest range at which any of these guns was ever fired, about 80 miles was 600 pounds. At the range of 74 miles, the shell reached beights of more than 25 miles.

Novel Shop Repairs Anything

A UNIQUE repair shop has been opened in New York City, organized like a modern department store, with separate counters and equipment for the repair of almost anything that people wear or use. Clothes, jewelry, shoes, watches, umbreilas and other classes of articles are all accepted for renovation.

Where Great Trucks Must Run on Log Tracks



A truck operating on the unique log tracks over which a lumber company hauls logs from the woods to the river

THE wild temberlands of Oregon, the problem of goong logs all the year

round to the nyer, which Houts them to the mults was a knotty one orbit this unique no thod was bit upon. The wheels of a standard truck were removed and replaced by pulley wheels. Then two tracks of logs were laid, from the center of activity down to the raver, and the truck set upon. them so that the grooved wheels fitted over the rounded trunks. The logs are nedched at intervals. and set into ties, to prevent spreading. No. steering is necessary.

Portable Diving Outfit Requires No Helmet



Helps to Keep Golf Clubs in Good Condition

TO FACILITATE the cleaning of golf clubs, a British inventor has perfected a limitly clamp which can be fastened to any table and which holds the club firmly while the head is accubbed and polished.

The device, shown at the right, really consists of two clamps. One is screwed to the perspecting edge of a table and serves as a stationary support; the other has movable paws which, when closed and tightened, grip the shaft of the golf club close to the head. The latter is lined with rubber to prevent marring the wooden shaft.



A Self-Feeding Glue Bottle

SUALIY the application of mucilage or gine is a messy procedure, and not infrequently the hands, clothing, or other objects in the near vicinity of the operation get as much of the sticking preparation as the thing 't is applied to. With the novel bottle pictured above, many of the objectionable features of the ordinary. glue pot are done away with. The applieation to made directly from the mouth of the bottle, over which a special gauze cloth is stretched to assure a thin, even spread. When not in use, the bottle is held in a suplike receptacle with the open end downward. The invention is espe-cially designed for work that requires frequent applications of paste.

THE simplicity and light weight of a new diving outfit invented by Commander I ves Le Prieur, a French naval officer, is said to make it ideal for undersea work in comparatively shallow water where the pressure is not great enough to affect the unprotected body. It was successfully tried out recently in the Mediterranean sea where submarine color photographs were being taken.

No belinet or air hose is needed. Goggles protect the eyes. Air is supplied from a tank carned on the back of the diverand operates automatically

In the upper picture, the inventor is seen trying out his device in a Paris swimming tank. In this test, he remained under water ten minutes. The rear view shows how the tank is strapped on to the

diver, leaving both arms free-

Machinery Polishes Apples

THE gloss imparted to the skins of Washington apples is produced, in many cases, by special machinery. The machines first clean the fruit, then heighten the color by the friction of 500 lats of canvas whipped across the apples as they pass over revolving rollers.



The golf club is beld firmly in a ricinp while the hand in being acrobbed and policibed

THE use of revolving brushes driven by



Titled Inventor's Device Used by Royalty

SEVERAL members of the English Royal family, it is reported, have adopted this "call disk" invented by Lord Louis Mounthatten to forestall the annoyance of being awakened too early.

The simple contrivance consists of two metal disks, one rotating beneath the other. On the top disk are engraved the words "Do not call me until." Under these words is a slot through which appears the hour of the day, engraved on the second disk beneath. The device is set by norms of a small lever which rotates the under disk until the desired time for roung appears through the slot

The dock is attached to the bedroom door of the awner, and, we are told, can be obtained in gold, silver, or ivory, as

dearted

Music Moves Our Feet

WHY is it that most of us heat time unconsciously with our feet whenever a lively time is played? The reason, says the Swiss attential Hospli, is that the nerve centers which react to the sensations of hearing music are located in the feet, at a point in each foot under the bend between the ankie and the toe hones. Moreover, the nerve spots which react to musical rhythm, he adds, are in the feet, near the big toes. In the feet also are the nerves controlling the similar to dance rhythmically.

Electricity Shines Shoes in Half the Time

I electricity is a late development in the abor aliming industry. In a new electrically equipped stand each seat is provided with a number of brushes for different pusposes, which can be changed without stopping the motor. These brushes, whiching at a speed of 1200 revolutions a minute, first thoroughly clean the shoes, then polish them. A high, hard polish is impurted in less than half the usual time, its makers claim.

Another improvement on the stand steelf in the folding foot rests, which can be turned back against the stand when not in use, thus affording easy access to the chair, as well as safety when stepping down. The rests also can be rused or lowered to suit the height of the patron.

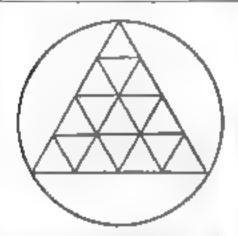


November, 1926

Quiz Yourself!

Six More Sam Loyd Tests to Measure Your Abilities

SAM LOYD, greatest pussle maker in the world, a offering the best of his pussles from month to month in Popular Science Montally in response to many requests from our readers.



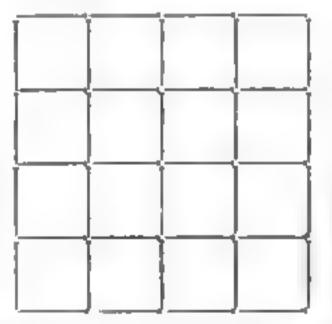
Here's a Stiff Test of Your Memory

IF AS an autoist you can retrace your path instantly in a mase of roads, you'll shine at this pursic. You are to show how the figure above may be drawn by a continuous line of fourteen strokes—the circle counting as a stroke. You may start and finish anywhere, and your line may cross or retrace itself. But such turning point starts another stroke. To find your rating, see page 163.



Can You Calculate Quickly?

SOME of these laskets contain hen eggs, the others duck eggs. Says the grown "When I have sold all the eggs in a certain basket. I'll have left in the other baskets twice as namy hen eggs as duck eggs. The number of eggs in each basket is printed on it. Which basket must the grocer dupose of to prove his odd statement? The speed with which you find out will show your abouty at mental arithmetic as rated on page 163



Aside from the entertainment they afford, these parales become real tests of your shifity in various lines, if you time yourself in sowing them and then compare your time with the ratings appearing on page 108,



Have You a Head for Figures?

You have a head for figures and a good reting for ingenisty if you master this lattle poor in four minutes. You are asked to mark off the clock dial into six sections in such a way that figures on the parts will add up separately to like totals. Each of the six parts must contain the same value in numbers. When you we finished, turn to page 103 for the solution.

Are You Analytical?

THE ingeneous per puzzle at the left will be easy for you if you have real power to visualize and analyze. The diagram contains 16 little squares, and these squares form larger squares, making 30 different squares in all of various sizes. The challenge is to discover how few plus you must remove so that no perfect square will remain in the display. Time yourself, then turn to page 103 for the solution and your rating.

Maybe Your Gift Is Languages

If YOU want to prove that you have a hudding talent for linguistics—also that you're bright and elever—try this one

Of course you would name the vowels a, e, t, a and u and sometimes w and y. Now see if you are clever enough to make a complete sentence from just those seven letters. Work as fast as you can, and when you've succeeded, note the time it took and turn to page 163 for your rating.

Have You Imagination?—Can You Straighten Out Mix-Ups?

SOME persons have imagnation where figures are concerned, others with line and form, still others with rolor. A gift for imagnative word play is probably what you have if you make a high rating in the clever" pied advertisement" test given here.

An enterprising merchant dressed up these seven sandwich men and sent them through the town to advertise his business. In dodging traffic, the original line-up became duarranged, as you see it in the picture,



so that the letters they now entry convey no intelligible message.

See how quickly von can put the men lack in their or gand order, to learn what was being advertised. The merchant's name was dispayed on the other side of the sandwich men, so that that needs t concern you in your efforts to find the answer.

Work at fast as you can, time youngelf, and then turn to page 163 for the soution of this test and for your rating.

Long-Nozzled Sprayer Lets Few Bugs Escape



A unique lasser killer for your garden

Invents Novel "Heat Cabinet"

N ENGINEER of La Crosse, Win., A has devised a new type of household radiator—a "heat cabinet," less than one tenth the weight and bulk of the ordinary steam radiator. It consists of a single Ushaped copper pipe, with copper fine, extending all the way across the cabinet and back again, thus preventing it is mad, the formation of air porkets

How Much Do You Know of the World You Live In?

IF YOU can answer half of the following twelve questions selected from hundreds of queries sent in by readers of Popular Science MONTHLY, you can claim a high rating. The correct answers appear on page 165.

- I. Which is the highest mountain in the United States?
- 2. What percentage of the United States is covered by forests?
 - 3. What place has no time?
- 4. What American city is built In a lake?
- 5. What is the most famous ocean current?
- 6. Why does South America have its winter in July?
 - 7. What makes London fogs?
- 8. Where do farmers cover their haystacks with mud?
- 9. Why were the pyramids built?
- What is the deepest place in the ocean?
- tl. What is the finest bathing beach in the world?
- 12. Where are pacial plants grown through sheets of paper?

FILLING and refilling of a sprayer when there is a lot of insect-infested ground to cover is not necessary when the container holds as much of the inserticule as this sprayer, illustrated at the left, does. Moreover, despite its axe, it can be carried quite conveniently, being slung from the shoulders by means of straps,

The vaporating apparatus inside the container is worked by a crank convensently placed for the right hand, while the left hand does the spraying. An extension pape holds the nossie far enough away to keep the contents from getting on clothes or skin, thus making the task a clean as well as efficient one.

Hidden Lampe Paint Fish Bowl with Light

ILLUMINATED aquarous in odd vascike shapes are new decorations for the home. The aquarium is illuminated

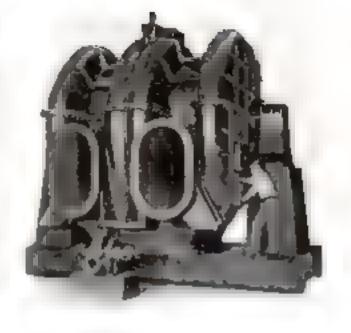
by the glow of a small electric bulb. concealed in the base, Really beautsful effects are schieved by the light filtering up through the seaweed and reflecting the golden tuits of the fish or the softer colors of the little "castle" and shells.

The aquariums are equipped, like floor and table lamps, with switch cord and plug The one illustrated is twenty inches in beight, with a base and top of metal.



An electric bulb is hidden in the bess

THE BOYAL ACTOMORUE CLUB of Sweden, as a service to its members, in putting mechanics along the country roads near Stockholm, who patrol the roads, act as guides and advisers about road conditions, and help repair stalled automobiles.



World's Largest Pump Built for Power Station

O PRODUCE the tremendous quan-I titles of steam needed for the great turbines of the Philanelphia Electric Company's power station at Port Richmend, Pa., the largest pumps in the world were built. The photograph above shows one of the two pumps attacked to a colossal steam condenser. The pump's manenso proportions are evident when compared with a standard size 750-gallon. pump in the foreground.

The giant pump has a capacity of 80,000 gallens a minute. Working twenty-four hours, it would pump 115,200,000 gallons of water, more than half the total daily consumpting in Philadelphia. The unit weighs 100,000 pounds and requires 500 bersepower for

full operation.

Experts Test Chromium Plating

WIAT chromome plating will protect steel for as long as ten years, is the reported result of tests recently conducted by the 1 S. Bureau of Standards. These lesta, known na ' salt sprny corronon,' were made by appraying the plated parts with a finely divided salt solution.

Nickel plated parts showed mut through the coating within two hours, while chromatin withstood the corresponfor a hundred hours before domingenting.

He Walks on Water in Ingenious Paddle Shoes

CARP boards have given some of us the thrill of skomming over the water standing up. Actually to walk on the water, however, is a dream which has inspired countless ingenrous inventions, The latest as the strange-looking apparetus Dictured at the right. the invention of a voung German

engineer. In his old "water shoes," as he calls them, he has been strolling about the surface of a Bayarian lake this last summer. to the amusement of rowers and swimmers

Out of the aides of each "shoe" project two flappers which serve the purpose of wide puddles, propelling the shoes forward. Standing up between them, the young inventor controls the flappers by means of oarlike rods. As he pushes and puds the rods, the flappers dip in the water with a rotary movement. The four "Support" dip to the water of he pushes and pulls with the parlike rods, propelling him shoud

Rotary Pocket Translator Aids Tourists

THE traveler in France who carries the ingeneric device above among his effects has the language, or as much of it as he is likely to need in an emergency. I tendly at his finger tips. On the side of the chart shown here are all the questions the townst most frequently asks. On the opposite side are the equivalents in French. By turning the indicator around so that the slit shows the desired request in English, a pointer at the back of the chart is turned to the equivalent in French. These rotary translators are also available in other European languages.

Why Your Bills Last Longer

AS THE result of experiments by V. S. Bureau of Standards experts, the new paper currency now issued by the United States Treasury will enjoy a length of life in circulation just double that of the old bills, which usually lasted twenty months.

A machine was neveral to test the new paper before it was sent to the Government printers. The material was subjected to the same rough treatment it receives in cremitation. One part of the testing machine foods and refolds the paper repeatedly, until the creases break. Other parts pull at both ends, blow holes in the center, and even tear the paper lengthwise and across.

By such regorous tests, the paper that showed most durability was selected.

Handy Bookmark Drawing Tool

THE handy little celluloid rule shown below will serve as a bookmark and is adaptable as a compass for drawing circles. For this latter purpose, it has two rows of holes at suiteenth-inch intervals. A pencil point is inserted in the hole at the desired radius, and the rule is turned around the central point, completing the circle. Other comple geometrical operations are also possible with the device.



Drawing a circle with the pocket rule. Marked off its inches, it makes a meful hookmack

"Mammy's" Biscuits Now Machine-Made

O' SOUTHERN plantations the family used to be wakened in the morning by the sound of the cook heating bucints with an air handle on a special ash bucint block. It took just therty initiates for the biscuits to use after heating, which gave enough time for the family to use and dress.

Southerners, and Northerners as well still like finfly heaten biscuit, but demand an easier way of making them. A machine invented recently heats the biscuit in a third the time and with little labor. The dough is run back and forth between rollers amiliar to those on clother wringers, as shown in the picture

The first models of the new biscurt kneader were hand-operated, the cook turning a crank which revolved the rollers. But even that labor is eliminated in the electrical model, which is motor-driven.

These delicants biscutts still follow the old recipe—flour, sait, shortening and liquid being the simple ingredients.

Milady Adopts the Mirror Hat

Possibly the rear-view mirror on automobiles formshed the idea for this but reflector for the pedestrian. In two shakes of her head the fair wearer can put it to dual use a look behind, and reasour-



A novel place for the runr-view micror

ance as to facial make up. The mirror is fastened to the under brint at an angle, and with a little practice the wearer may become quite adept at seeing what goes on behind her

Magic Number Puzzles Berlin

THE mysteries of the number 5852 are taking up all the attention in Germany hitherto devoted to solving crossword puzzles. It has been found that the year of your birth, your age, the year of your marriage, and the number of years of wedded lafe, always add up to that number exactly.

The pumile is extremely interesting, and even bewildering at first, but the most simple analysis reveals it to be based on the fact that it is nothing more than 1926 doubled. The addition of the year of birth and the age of course, always results this year in 1926. So will adding the year of marriage and the number of years married. Next year, obviously, the "mysterious number" will be 3854.



World's Most Luxurious Car

A AUTOMORILE recently produced in France, described as the most becames in the world, is reported to have a wheel base fully saxty melies longer than the usual cur. Equipped with a souther, motor, its speed is said to be mostly miles an hour.

KNOW YOUR CAR

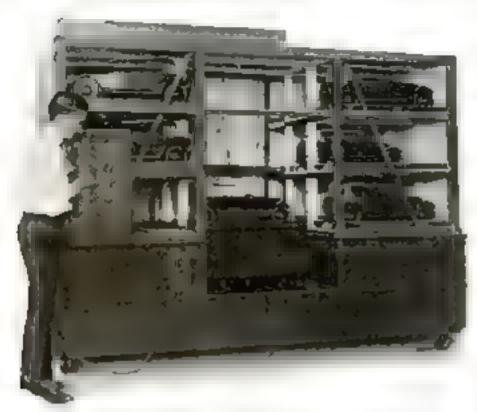
My motorate are under the impression that considerably more gosome is used to hilly country than would be required to drive over the same distance on a level. This is true in some cases, depending on the nature of the road surface and the atcepness of the grades, but it is quite possible to drive a car over rolling country in such a way that the gasotine consumption is little if any more than for level going.

accomplish this result. Wherever the grade is steep enough to permit constant, shut off the engine and coast with gears left engaged it high speed and the chitch pedal held out no that you can start the motion at the bottom of the hill by letting in the clutch. On moderate grades letting in the clutch now and then will have the brakes.

Remember these rules in hilly going if you want occoping

- 1. Coast wherever possible.
- 2. Keep the car in gear at all times.
- Shift to second at the top of a long steep hill.
 - 4. Don't ruce uphill
- 5. Shift to second and hold moderate speed going up very steep hills.

Automatic Parking in "Bookshelf Garage"



Demonstrating a model of the surometre garage. The car owner peed only throw a switch to send his machine to its stall

THE up-to-the minute garage soon may be so equipped that an automobile can be carried from the garage driveway to its stall on an upper floor without human manipulation of Pred Cross, of Los Angeles, comes into general use.

The car owner simply turns a key in a sustebboard. This starts a perchanging which operates elevators, turntables and that s all there is to it as far as the driver is concerned. In the pictice at the left a model of the device is shown in operation.



Golf Club Serves as Handy Pencil Holder

MY a golfer has strained his metaory to the breaking point in an effort to keep table on the score, simply because he has careleasly left his only pencil in his yest in the locker room.

Here is a povel idea for comming that the pencil will be handy when the gulfer wants it. It fits into a metal holder which can be inserted in the end of the club.

White Line Saves Highways

THE white line you see painted down the center of a highway has a use other than that of regulating motor traffic, theorge F. Schleunger, Ohio Highway Director, has found that it helps to lesses road repair buls.

When a road is divided by a line, he says, drivers feel assurance that they won t be side-swiped by opposite traffic. As a result, they drive farther away from the curb, thus saving much chapping and breaking away of the pavement.

Statues of Speed Kings Mark Roads in California

THE beauty of Canforma boulevards as being enhanced by sculptured road markers of the type illustrated below. The statues are almost life-size, and are modeled after famous noto racers. The one below is near Los Angeles.



Statue of Bennett Hill, noted racer which is serving as a road marker in California.

Exemplearings at the Krupp works in Essen, Germany, have devised a new method of treating chromom, abundous or manganese steris to produce a hard steel "skip" on the surface of the metal. The steel treated in this way is said to be especially suitable for machine parts which function under high temperatures.

Doctor Operates in Planes

A FRENCH surgeon whose war-time a method to perform operations in maving velocies, recently auto most that he has perfected a system by which he can perform the most complicated operations in a flying surptane, moving trum or anibulance. The system consists of a series of five instruments so constructed, it is said that they do their work accurately and independently of the motion of the train or plane, and at the same time hold the patient in a firm position during the course of the operation.

Experts Perfect a Pocket Gas Mask for Miners

THE U.S. Bureau of Miges recently designed this compact gas mask for use by miners and radway workers who are often exposed to pursonous furnes.

The mask shown is no larger than a can of to-bacco and fits into the hip pocket. The cantsteps are filled with an absorbent mixture of activated charcoal and soda lime, with filters of toweling. The nose piece is just a spring clamp and requires an adjusting, as it is



brought into position when the usuallipiece is placed between the lips as in the diastration above.

Army Horses Made Slick by Vacuum Cleaner

The vacuum cleaner makes groomand mester

and only
ough
tape
The
qual
old
The
flyte

ARMY borses at Fort Ben pants Harmon at Law-rence, Ind., have no kick to make over their grooming these days, thanks to the success of a vacuum brush invented by Capt. A. C. Fitzhugh of the Third Artillery. The new brush, it is said, not

only cleans the animals' coats more thoroughly than the old scrubbing methods, but makes the grooming task easier, more

rapid, and less dangerous.

To apply the vacuum principle, Captain Fitzhugh had to devise a special revolving brush to fit into the noszle. The animals are massaged in a manner quite the same as that followed with the old grooming brush and curryromb. There is not so much danger from the flying heels of a refractory animal, either, since the groom can stand well away from his work.

Deaf Pupils Hear Teacher with New Phone



"Vacuum Cleana" the Neck after Haircut

NOT even the most carefully tight awathing of the neck by the barber keeps tiny hairs from shipping down the back, where they defy all attempts at removal and are a source of annoyance and irritation after the feminine "bob" or manly haircuit.

Now an effective remover has been devised in the form of a minute vacuum elemen, shown above, with a miction powerful enough to dislodge the most tenacious hair from the neck or back. It can be pugged into an electric light socket.

What Causes Tire Failures

INTERESTING conclusions regarding the engurance of automobile tires were reached recently by experts of the U. S. Bureau of Standards, it is reported, after tests extending over two years. Among the most important of their conclusions were that a tire stands up better under higher pressure (within customary limits, of course) and that most failures are due to the separation of the place, which occur mostly between tread and breaker, confron and careaus, breaker and cushion, or between the outer two place.

The tests were made on machines specially devised. The tire was mounted to revolve freely against a druin, with the desired axle-load obtained by a system of weights. The tests were made severe by attaching cleats to the druin. A speciometer connected to the druin showed the innes "traveled" by the tire. The speed was therty index an hour



Suspended on belts, these pupils learn swimming without any feer of sinking

BEFORE radio principles were brought into play to the education of deaf and partly deaf cluddren, the process of instilling the fundamentals knowledge was slow. and laborious. The modern method is diustrated berewith as it is applied in Jackson Piace School, Baltamore, Md., where a new apparatus enables the partly deaf children to bear their teacher riearly



Fread purpose of a bias more a book using the unsigner new seasing acquired to take lambda in groups of the

Fountain Pen Gun Shoots Gas

HARMLESS in appearance but quite effective as a weapon against bunchts or burglars is the novel fountain pengangun" pictured below.

The gas is contained in a cartridge in the larrel of the pen, and as released when the thumb presses the button "trigger It is said to render its victim helpless.



A surprise attack—greeting a *bondit" with the innocent looking fountain per gus

immediately, at a distance of twelve to lifteen feet. The effect, though complete, is not permanent, as the gas is non-possesses and cannot full anyone. The cartridge is practically the same as that being used in gas gans by the police of various cities.

Its small size and resemblance to a fountain pen make it easy to operate.

Swimming Apparatus Keeps Learners from Sinking

GERMAN assumming instructors are adopting apparatus like that illustrated at the left for teaching their pupils the rudiments of the aquatic sport. The idea is that the learner will pick up assumming more quickly when the fear of sinking is removed.

The supporting lines attached to the belts on the pupils are adjusted to permit immersion to the proper depth for swimming. The movements are gone through in unison, in measured beats as called out by the instructors.

When the beginner has attained confidence, he is allowed to swim without the mechanical supports, and is then put through other exercises to render him more proficient in making himself at home in the water.

Notice process of the caloric energy we require is furnished by five articles of food; bread, 57 percent, fats. .6 percent; meat, 15 percent, sugar, 10 percent; and white potators, 12 percent.

Invents Underwater Goggles

SEEING under water is impossible for the swimmer because the sem of the homes eve is corrected for the refraction produced when in contact with air, and the light does not converge properly when the eye is in contact with a I quid mich as water. To remely the condition, Michael O Flanagan, of London has invented a part of underwater goggles that fit watertight and so bold an air space between too eye and the water. It is reported that objects can be seen quite clearly through the water with these goggles, provided there is sufficient light,

THE NEW Charge Zoo will have a monkey boars so which the heating piper form a network underneath the tile floors. It is expected that the warm tile floors will make drafts an impossibility and keep the monkeys comfortable.

This Shovel's Easy on the Back

ITS peculiar shape and the diamond point make this shavel easy to shave into a pile of dirt, metal or rock, and the steps allow extra pressure to be exerted with the foot without damaging the sole

of the shoe. The shovel in smaller than usual for the amount of material it will hold. The handle wof pressed steel that cannot warp, and is suid to be easily repaired when it has become damaged through extremely rough usage.

Note steps on the eroop, making at easy to certs extra pressure without damaging the shoes



New Household Helps

Curling fron Stand

If the curl comes out of miledy's locks, at own be pest in again even if neither gas may electric current in available. A special stand for curing from to be used with cannot been bas been devised cright A sent best prevents the canfrom marring the dressing table



Bottice Sterilized by Steam

With the ingenious device at the left, baby's bottle or the comming jar is thoroughly sturilized by steam in a few minutes. Weter in the gen is turned to crouse, which seconds through tubes to the bettler placed on a place above the water level. The can away view of the pun shows the samplicity of the operation



A Versatile Kitchen Chair

Repectally designed for the right housebreging dweller in the abbreviated bischenette opart most to the combination device above. A hitchen chair ordinarily it can be converted immediately into an ironing board when opened up. The supporting leg for the board folds buck into the frame after bosting



Foot, Not Fingers, Sets Ret Trap

There's on danger of crushed fingers from this rat trap, according to the inventor, The killer wire does not come als the way back, end the trop is set ofter the built has been placed on the book, by stopping on the plate in the year with the foot

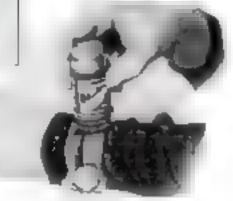


A Leather-Strap Jar Opener

A leather strap and a pointed wooden handle are the simple parts of this practical device for opening feult face. The pointed ead on the side to which the cover is to be turned present the leather tightly against the cap, unacrewing it without morring it



Extracting the juice of needy or pulpy fruit struming it, and pouring it unto the glass, in all rett operation with the combination device at the left. The holes in the persiner new tust too pmall for the passage of most seeds. The device shown is made of chine

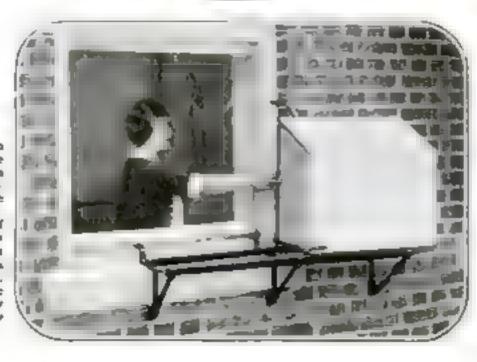


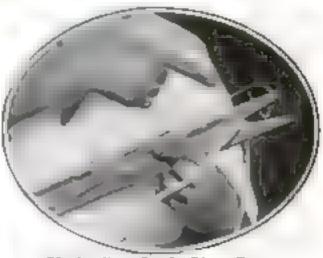
Removes Spots on Clothing

For removing a spot or state on clothing, this compact outfit above combines a brush, cleaning compound, and absorbent felt. The brush at one end is moistened, the spot rubbed, the "pencil" reversed, the compound applied. Finally the felt, impregnated with the compound. Saishes the job

Saves Ice Bills in Winter

Out of sight and out in the cold, saving the winter see bill, is this outside the window 18. frigerator. It can be furtened to any window the maker mys. Made of metal, it so divided in two compartments. The winter réfrigerator slides. back and forth on tracks. and opens toward the maide when slid directly in front of the window

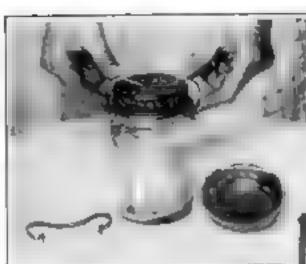




Clothesline Can't Blow Down

A threaking wind on washday often collifica the work of the laundress by blowing the clothesline off the clothes pule. This wire device across the claft prevents such an accident

Women Are Using

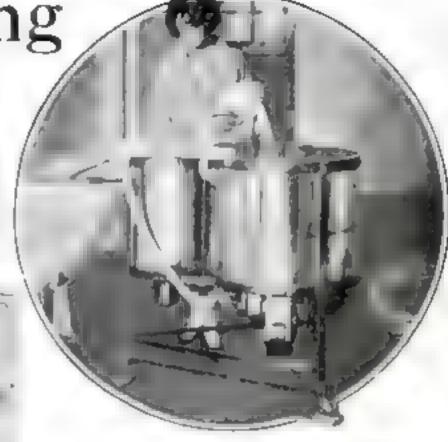


Jar Cap Clamps On

This cap for causing part to put on withtrut strenging, and held struct by the clamp until the jar cools arough for removing the clamp. No rubber rings are required. Heat must be applied, when the jar is cold, to remove the cap



If you haven t spect for a breakfast nook, this movel interes cabmet below at least supplies the convenience of our. It concerns a table and two benches which when not in our fold up out of sight in the cabinet



Washing Machine with Auxiliary Tub for Automatic Wringing

While the electric weshing machine eliminates rubbing, with most types it is also observantly to pass the clothes by hand through the electric wranger. Some machines are equipped for centralizal wringing, but this method makes frequent changes of water property. The new machine above solves the problem by provining an extra tup for automatic centralization wringing



Clothesline Comes on Reel

The clothesine is kept to better condition of its would up and taken in after use. This real makes doing so easier Mark of ight ment or is the right also to accommodate be promisely family length of sother as



A little carry pressure on the hapdle of life meaning device below turns its otherwise straight edge not a turne for scraping the maids of mund but turn bett to site parts, reprintly no term stands gamepans, has are build to get and order a arranght acreper





Shown above is an ingenious shaded electric light that can be attached firmly to any flat surface merely by preming it against the wall or furniture, Rubber vacuum cups in the back do newly with all extra clamps or other adjustments for fastening



Holder for Jelly Strainer Cloth

Another canning accessory is this device for holding choeses of the bolder the parts are between the two halves of the bolder the parts are clamped together, and the jelly is poured through

Step-Stool Folds Up

Reaching for high places an wobbly chairs has resulted in many a manty full for the homewife. This convenient, stable, metal stool (left) insures a safe return to terre forms. The lower step folds up

Battery Charging Made Easier



How Trickle Chargers Are Tested

At the Popular Brience Institute of Streederds Radio Laboratory trickle chargers are trained so shown above: by continuous running under actual working conditions to make such they are efficient. Chargest must pass rand state to was approval

NROM the point of view of its electrical characteristics, the lead acid type of storage battery is an ideal source of current for heating the filaments of the vacuum tubes in your radio receiver. A storage battery gives a steady, noneless flow of current and the voltage drops only a fraction of a volt while the battery is being used, so that when it is nearly shacharged the voltage is only slightly lower than it was just after a fresh charge

You cannot however, metall a storage buttery and then forget et. The current that you draw out to run the radio receiver must be replaced by recharging. The level of the socution in a storage battery of the ordinary type, moreover, must he watched to see that it does not get below the top edges of the plates.

While you have used the storage buttery. because of its fine electrical characteristics, the need for remembering to charge it and to add water probably has made you wish for an A-battery eliminator built along the masse lines as the modern B-eliminator.

However, instead of eliminating the storage A-battery altogether, ways have been found to get rid of its disagreeable features. One way has been to make the buttery with an ample capacity for water so that filling every two weeks is no longer necessary. Once every two or three months is enough with these batteries.

The other hig development has been the introduction of a different method of recharging the battery. The new way is to charge the battery continuously at a slow rate instead of periodically at a

This is the result accomplished by the proper use of any one of the new types of trickle chargers now on the market. In theory these chargers work just like the ordinary battery charger with which you are familiar. The only difference is that the trickle charger is smaller, costs less to

F YOU are building the powerful new five-tube radio receiver described. last month, turn to page 76 of this usue, in our Home Workshop Department for an article letting hose to get the best results in operating it.

buy, and is designed with an output of about one half ampere as compared with the two to five ampere output of the full sused charger.

The great advantage of the trickle charger is that it can be connected up to your alternating current electric light supply and the tudio A-battery and left turned on all the time. The current drawn out of the battery while the radio receiver is in operation for a few hours each evening is gradually replaced by the trickle charger when the set is turned off

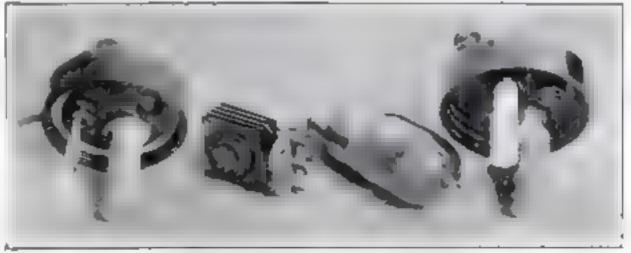
If your radio receiver is not used for several days at a time, the trickle charger will bring the battery up to full charge and after that the energy of the charging current will be used up in slowly decomposing the water in the battery solution. It has been found that no barm as done to a battery if a small current is sent through it continually for long periods of time. In fact a trickle charge of this type is one of the standard treatments used to restore storage butteries that have lost part of their capacity because of sulphate deposits.

In spite of the fact that the excess current uses up the water in the battery, the total amount of water that has to be added to the battery is considerably less with the trickle charger than when the battery is charged at intervals at a much higher rate of current. This is because the amount of water decomposed is quite large while the battery is being charged at a rate of two to five amperes.

An important feature of the trickle charger system is that it permits the use of a small capacity, low priced battery. since with continuous charging there is no necessity for a large reserve capacity. It can, of course, be used with your largesized battery, but a battery of between forty and sixty ampere hour capacity will do quite na well

A LL trickle chargers for use with alter-nating house current consist, essentially, of a small step-down transformer to change the 110-you current to a low voltage, and a device for rect fring this current so that it will charge a storage battery.

I nder average conditions, the cost for electric current used to keep your radio A-battery fully charged is about the same whether you use a trickle charger or one designed to be used internattently at a higher charging rate. Assuming that your ranto 1-battery is in good condition and not too large, the 14-ampere trickle charger running continuously will take care of the current requirements of a radio set of mx to eight tubes.



Vital Parts of the New Trickle Chargers

At the left and right are the elements used in two electrolytic types of trickle chargers. The flooged piece is dry onide ractifier element and the small holls is used in other makes

Are You Living in A Radio Dead Spot?

How an Obstruction May Prevent Your Hearing Near-by Stations — Some Possible Remedies

By ROBERT E. MARTIN

ON'T be too quick to blame your radio set if you get poor reception. Perhaps you are living in a radio "dead spot"—a place where the radio waves are received only weakly and sometimes not at all

Hadio waves, as they are sent out by heualeasting stations, act in a peculiar way. They do not spread out uniformly in overy direction. In most cases they are radiated in overy direction from the broadcasting antenna, and if conditions were equally perfect in each direction, a radio receiver 100 soles to the north would register the argumbs with the same intensity as a set 100 miles to the

south. Unfortunately, many things happen to the waves after they leave the antenna. They are reflected, absorbed and apparently diverted.

A wealthy baseball fan in one of New York's large new office buildings recently decided to install a radio receiver near his desk so that he could get the reports of the World Series games. An expensive, loop-operated outfit was set up early one marning by an experienced radio nervice pant. The baseball fan invited some friends to hear the results of the

from their original paths.

game that afternoon, but he was estopoled to find that the set would not bring in the desired station, which was located so near his office that part of the isopaleasing antenna actually was visible from the window beads the set.

The rate owner immediately called up the radio store and the service man came on the jump. But he was no more soccessful than the owner in tuning in the desired station. Other stations in Newark and those located farther uptown in New York could be brought in with about average intensity, but something in the arrangement of the steelwork between the two buildings completely shut off the radio waves he most wanted to get.

THIS undoubtedly was an extreme case. Ordinarily, a powerful station can be heard with reasonable intensity in every direction for at least 15 to 23 miles on a good set, regardless of the steel work or other obstructions

But the map in almost every broadcasting station will abow at least one section of the surrounding territory where reception is not so good, and yet another broadcasting station located only in few blocks away may have no difficulty to sending signals of ample volume into that particular locality. Just what causes these peculiar effects as not yet clearly understood. Steel buildings undoubtedly absorb some of the strength of the radio waves as they pass by. Mountains also appear to have considerable shielding effect on radio waves, particularly those containing a large percentage of iron ore or other metallic deposits.



What Causes "Dead Spots"

The concentric circles above represent redio traves sent from a broadcasting station. When the waves strike abouttains or steel structures, part of their force is absorbed. If you cannot have a steer by station, you are probably living in the pocket. Formed by such obstruction

There are radio dead spots of all degrees, but localities in which no radio signal can be heard from any direction are extremely rare. Radio installation men have found that many sections of Westchester County near New York City have extremely poor reception for even the powerful New York stations. On the other hand there are large sections in the East and Middle West where radio reception is so good that almost any kind of a vacuum tube receiver will bring in distant stations.

While the craze for bringing in distant stations night after night to gradually dying out and few radio fans now spend their evenings trying to see how many distant stations they can log, there are thousands of listeners all over the country who are forced to get distant stations or else do without radio entertainment attogether.

If you are located in a spot that is not so good for radio, you will want to know what to do to overcome this "dead spot" effect. Tests have shown that radio waves do not always travel in strught lines. Reflection and re-radiation occur to such an extent that the observer often finds radio waves apparently coming from a direction indicating bending of the waves. This reflection may sometimes be used to help improve reception.

If a loop-operated receiver is set up behind a steel building, for austance, stations on the opposite sele of the steel building may be heard but the loop

> probably will not point within many degrees of the actual decetion of the station.

THE effect inside a mildera building constructed with a steel frame and wice

lath bridge out this apparent hending to a marked degree. For the stance, a loop-operated receiver was tried out a short time ago in a naclern ligh school buikling at East Hampton, Long Island. It was placed quite near a large window in a lecture room. A number of distant stations were heard from many different directions, but no matter where the signals came from the loop always.

posited to the window. Evidently a queer reflection effect caused a minute amount of energy to come through the glass of the window to the loop rather than through the steelwork of the building itself.

In some cases, the distribution of the steelwork in your neighborhood is shielding your unterns so as to weaken the signals from every direction or perhaps in only one or two carectooss. A possible remedy in a case like this her in shifting your apparatus to a new position.

SOMETIMES moving your antenna so that the free end points in the opposite direction may result in bringing in a whole string of stations that you never heard before

The case of the loop-operated receiver in a dead spot inside a steel building is not hopeless either. You can t move the loop very far, but you can atring up a wire waich will bring the signals that are passing by to your loop. The way to do this is to put up an outdoor antenna and then connect it to one end of a loop of a few turns of wire. Ground the other end of the loop on the water pipe and experiment with the placing of the loop with relation to the loop on the set until you get the best results.

Hints for Radio Beginners

When Your Set Goes Dead-

Try These Tests to Locate Trouble - A Simple Way to Avoid Acid Stains

ON'T rush to the telephone to call the service man the Best time your new rights set refuses to above signs of life. The trouble may not be such that a service man of presied,

If you lry to use your receiver some evening and not a sound comes out of The loudspeaker no matter where you torn the dials, the first thing to do in to make sure that the switch is turned on. The next is to see that the londspeaker plug is the perted in the pack. Surprising as it may seem, radio service mer, say that they are frequently called on when nothing it wrong except that the set is not turned on or the hundgreaker is disconnected.

Next, look over the hattery, autonos and ground

connections to see if a wire has come loose. Then look at the tubes and note if they are glowing at about the normal brightness. If they are all don, the A-battery as exhausted and needs replacement if of the dry cell type, or recharging if of the storage type,

One dim tube, with all the others normal, generally indicates a corruded



Holds the Hydrometer

A milk buttle arrives both as a place to keep the hydrometer so that damaging drops of acid canhat get on your clothes, and se a heady distilled weter consister or dirty contact. Take the tube out of the socket. clean the contacts, and the chances are that your troubles will be over. Of course if the tube is burned out the only remedy is a

Avoid Acid Stains

NE drop of the and solution from the storage A-battery will riou a mut of clothes by cating out the fabric, so be mighty careful in handling the hydrometer, A drop or two of and always stays in the end of the tube, no matter how vigorously you work the bulb to put the and back in the battery after you have taken a reading.

The hydrometer is a necessary piece of equipment to keep tab on the condition of the battery.

A good way to avoid trouble in to keep the hydrometer in a mok bottle. The milk bottle will serve, also, as a container for distilled water. The few drops of send that will get into the distilled water by keeping the hydrometer immersed in it will do no barm, and the hydrometer will serve as a syringe to transfer the distilled water to the cells of the battery.

Install a Lightning Arrester

ARADIO act may operate perfectly without a lightning arrester, but why take a chance on coming your recurrer or setting your house on fire2

All that the lightning arrester does is to provide a path to the ground for the electrical charge that accumulates on your antenna. Actually, the term light ming accested is a intenumer. "Lightmon diverter or "lightning by pass" are more exact terms.

The fixed gap lightning accester is a common and popular type. Essentially, it consists of two building posts connected to metal plates or points that are set with a small gap between them. Glased porcelain is ordinarily used as housing, and the arrangement is such that the gap is protected from the weather.

As shown in the diagram at the right, the wire from the antenna is clamped under one of the binding posts and the end is fastened to the antenna hinding post of the receiver. The other binding post of the lightning arrester is connected by the shortest possible path to a ground clamp fastened around a piece of fron pipe derven two or three feet into damp ground.

A wire can be run from the ground beading post of the radio receiver to the

grounded hinding post of the lightning arrester, or you can connect the ground terminal of the receiver to the nearest rold water pipe made the room. Try out both connections and see which is better.

Where lightning and static discharges are frequent, the continual sparking seroes the short gap mode the lightning arrester eventually corrodes the surfaces. Because the gap between them is so amual the roughness may result in a partial short circuit of the lightning arrester. If you are troubed with a follog off in signal strength that cannot he accounted for in any other way, disconnect the lightning arrester and see if the signals came back to normal strength. If they do, replace the arrester

Why So Many Binding Posts?

THE radio beginner who tacklet the bunding of his first set often wondeer why the design calls for so many binding posts that are all connected together made the receiver. At first glance it does seem needless to have a separate booking post for the minus B-hallery connection and for one of the A-battery wires, when et appears just as easy to clamp these wires under the ground banding post and save the cost of the extra posts.

There are, however, practical advantages in using a separate bunding post for each wire. There is less chance of making a wrong connection, for one thing, and, besides, it is difficult to clamp more than one wire under a binding post with the certainty that each were in making contact,

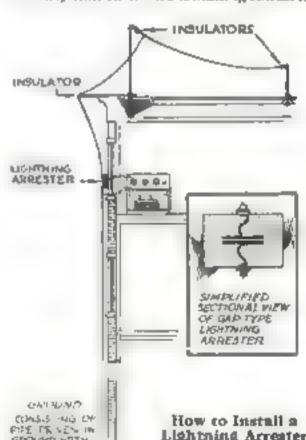
A B C's of Radio

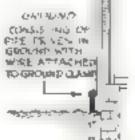
THE slightest cattle in the loud-speaker is enough to spoil the

Most often the rattle is due to forcing the radio set to the point where it distorts low notes and reproduces them as rettles rather than se musical tones. With adjustable loudspeakers, the rattle may be due to setting the adjustment so that the armstore is too close to the magnets, then, when a particularly loud note in received, the armature moves for enough to touch the pole pieces.

But there are other rattles, Occasionally icon filings find their way into the gap between the armature and the pole piece and interfore with free movement. At the pole pieces are highly magnetared, it is hard to remove the filings.

If the loudspeaker unit is of the metal disphragm type, screw off the cap gently and clean the pole pieces with tissue paper. The balanced armature type used or a cone speaker can be cleaned by passing thin cards between armature and pole pieces.

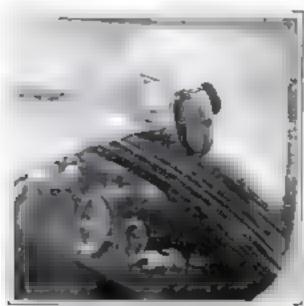




Lightning Arrester

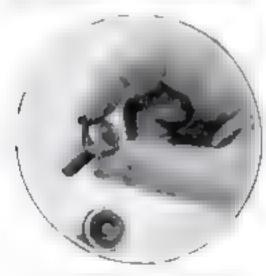
Your radio receiver will work has as well without . lightning errenter, but if you do not install one your set may be damaged or a fire started in your bome by a lightning flash

New Accessories for Motoring



Special Materials Silence Valve Clicks

It is absolutely necessary to allow a british of the control of guest property of the control of guest property of the control of guest property of the control of the cont



An Umbrella for the Matorist

The open of the front trees what will not exto from of the front trees what will not exyou from the room when you upust leave the one for what at again. It

can be put eway wet. and fits into a metal box with history for year sot off

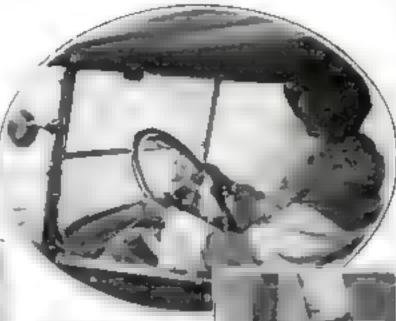
Catches Ligarette Ashes

What to do a the he ashes of a garage garage garages about a major a source and a major as each at the master that personal section is also because there doesn't seem there are them on the floor force of the about. The nonestable belief a section of the shape and appearance of the shape and an he ness are of the shape and an he ness are there are of the shape and an he ness are there are of the shape and an he ness are they could gloss and a chy threehold the state out appearance the state out appearance to the state out appearance of the state out appearance out the state out appearance of the state out appearance of the state out appearance out the state of the state out appearance out the state out appearance of the state out appearance out the state out



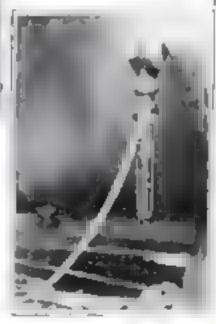
Vapor Olling of Unseen Parts

The ingent up deep culture where on the conthe tipe to that the sale con-hammer there not get energy that we say The act on of the rose of all deep on a supply of one of the form of separa. The name proposety attacked to hooke outstood the doing the rose of the acts the goal appears in his many fill



Windshield Wiper Oriven by a Figurile Shaft

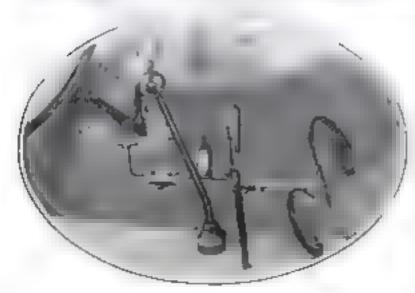
Above and right Instead of using an elect model to tag as moder operated by the suction in the granifold, then new a related to a per a side by a then ble about in factories to a some and the about in factories to a some some side about in factories to a some some side about in factories to a some some side factories and again the factories.



New Hydrometer Makes Testing kasy

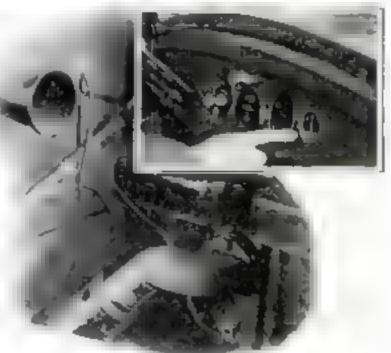
Jant below he rubber halfs as his leads onetes not there is a mark text a length of where is a mark text a length of when have earlier to be that each of the half of the leads of the text of the leads of th





Special Pedal for Auto-Droving Teachers

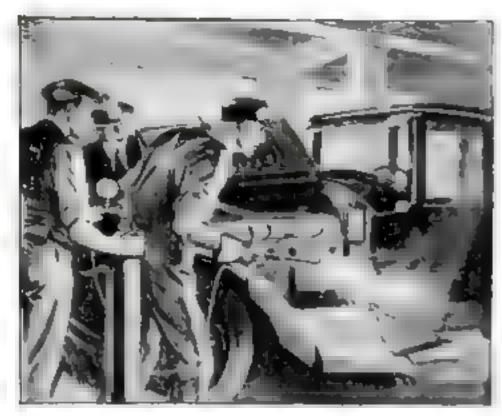
The danner in teaching a ben unset to drive an act stadies see in the chance had nervousness will rause the normal to lose control. A aperial new device permits the nation of the act to and apply the trake in an energency. The instructor's foot peaks an be footed out in the way when the detect in the way when the detect in the said solution in the detect in the said solution in the detect in the said solution in the



Gage to Indicate Motor Temperature

For best efficiency, the motor of your automobile should be operated at the proper temperature. The matrument above tells the actual temperature of the motor gaging the best in the water judget by the plug serewed into the cylinder well as shown

When Carbon Clogs Your Motor



Gus Tells How to Burn and Scrape It Out -Other Repairs That May Be Needed

By MARTIN BUNN

A rouring flame shot out of the spark plug hole.

That a just the oil burning up, Gue explained, "As soon as that is all gone the carbon will take fire. Bur the specks coming out now.

crapk halfway around each time and with eight cylinders you give it a quarter turn.

"How do you know the valves will be shut?" questioned Watford.

"That's easy," replied Gus, "The valves are always closed when the cylinder is ready to fire, so if you get it to the firing point you are bound to be nght."

Seems to me I've heard it's not a good siles to hurn out the earbon m a invitor that has a detachable head, Watford said. "They claim it is like,y to injure the gasket. How about it?

"It won't be damaged if you are careful and don't try to its the job too quick, and if you keep the axygen page may of all the time. I never had any trouble tisat way."

AFTER Gus had finished burning all as cylinders, he replaced the spack plugs, connected the wires to them, and started the motor. It sputtered and ran unevenly for a few moments. She Il run smooth as soon as all the loose particles of earbon have been blown out through the exhaust valves," he explained as Jug handed Watford his change,

As Watford drove off up the read Joe. noticed another car coming in the opposite direction. "Here a old man Burdett again," he exclaimed. "I suppose he's got a couple of complaints in his system

Joe a prediction was partly right, for Burdett stopped in front of the Model Garage. But be didn't register any (Contented on page 164)

FOW we'll see how good you are at burning carbon," remarked Joe Clark to his partner, Gus Welson, as the latter stood back and myveyed the portable carbon burning outfit he had just assembled.

"Hamph" God grunted. "If everything else around the Modii Garage gets done as well as the carbon burning I do.

we'll never have any kicks."

"Gueen I in going to be the first customer for the new outfit," called out-Arthur Watford as his car rolled up bebind the two garage men.

"Howdy, Watford. You want some earbon burning none I take it, said Gus. "All right, leave your motor running a mante. I want to see how had it in,

'Pretty west clogged up, I should judge," he continued after speeding up and slowing down Watford's motor several times, meanwinle lastening carefully "One evhader seems to be a lot worse than the others, but that's nothing unusual. How does she pull on the hills?"

"Not no good, 'Watford repord. "It doesn't man any explosions, but it knocks like the dickens if I open the throttle very much, and it hasn't nearly so much power

nn it sheald."

"Compression is fine, too," observed Gus as he turned the motor over with the crank. "Well, let's get started."

VI'S first placed a small fire extra-G guisher at a convenient place on the running board and then proceeded to remove a) the apark plugs and the plate that covered the valve stems.

"You re not suming to burn up the old bus, I hope," laughed Watford,

"Don't worry," advised Gus. "I haven't had to use the fire extinguisher yet, but you never can tell. An ounce of prevention is worth a lot more than a burned up auto, so I never take a chance.

"Watch that intake valve and tell me when it starts to close," he instructed, pointing to the intake valve on the first cylinder as he slowly cranked the motor.

'It's closing now," Watford called a second later.

"All right," and Gus, "Come around here now and turn the motor over real slow until I tell you to stop."

Gus inserted a piece of stiff wire in the spark plug hole far enough to touch the top of the piston, pulling it out gradually as the poston traveled upward. When it reached the top he agualed Watford to stop turning the crank.

"Now for the burning," and Gun as he furned on the oxygen and threw a lighted match into the spack plug hole, following it with the end of the copper pape from which a stream of oxygen was flowing.

A roaring flame immediately shot out of the spark plug hole.

"That's just the oil burning up," Gus explained. "As soon as that is all gone the carbon will take fire. See the sparks coming out now. That's the carbon.

US kept the end of the pipe moving so G that the gas was sent to every part of the cylinder head and the top of the purion. The quantity of sparks grew less, and finally the glow went out.

"That cylinder is as clean as

turned the crank exactly one third of a revolution. "You don't have to use the wire to find top center for the other pistone after the first. All you do with a six-eviloder motor is turn it over a third of a turn and then burn the next cylinder according to the firing order. See those numbers molded into the ade of the crank case⁵ Va. 5 comes

"Four-cylinder motors can be done in the same way. only you turn the

after No. 1, so we

burn No. 5 next.



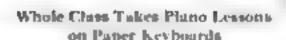
Odd Methods of Clever TEACHERS

Traffic Rules Taught by Game

How to oping attents and by a being taught a hilleren of he Warcon Junton High School by means of a tovel speciming arrow game above useen a by world their on hers. The tob centure if appears at a motion a boart expension on a second or present on a trade of super-trade or to the contrast of super-trade or trade or trade or trade or trade.

Getting the Inside Facts

English agen at our students wit herewall the analyte so of a figure of an area of a figure of an area of a figure of the state of a figure of the strong tell was to be against a figure of the strong of allows. He is not the estate of a strong of allows. He is not the estate of the strong of allows.



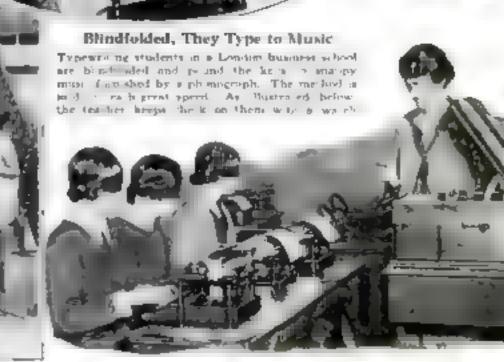
Paper her boards are being used. Less had deten juste daying in Visionings. A passe has really paper would be datued as some versus as above above, the children take turns at the few real points place, a must be a sur-white other popula at their sens a play, the same soules and tubes on pager beyon

Children "Act Out ' Geummar Rules In Playlet

That dend visible is grammer to be not religible by the united of a few method, greened in a few method, but it is a few method in the post of a few method, and a few method is a few method in the second disposing that a special and passed a few marks on the actions at a few affects of the actions at a few marks.

Music Teacher Invents Devices to Strengthen Fingers

A Lemous in a c ten he has evented stagration is now as by who has been a reflect the print of the print akremy: hen gen without estually playing their mateumen a. Here he is no structing pupils in the spec of type highlylling geft to right worlding ceib nor giants. The fourth pure is duing the of toper ever time will be not early er has de ned for ner



Handy KINKS for Your Car

Hooks for Tire Irons, Fender Tool, and Other Ideas

ANY a motorist has wished be had three hands when he tackled the job of changing tires. The third hand would be mighty useful for holding one tire iron is place while the second was applied keeping the unruly tire from moving across the floor. An ingenium way to make up for the lack of a thord hand is shown in Fig. 1. The ordinary type of tire iron, or one made from sections of old automobile springs, is drilled with a large hole at one end. A number of books are bent up from quarter-meli iron rod. By making these hooks of various lengths, the tire iron can be held at the point desired without fear of nlipping.

Simple Syphon Starter

ITS easy enough to start the gasoline applicating out of a tank into a near-by can with no other apparatus than a length of rubber hose. But applying the necessary suction with the mouth generally results in getting a mouthful of gasoline, and gasoline these days is far from being a pleasant form of beverage. The difficulty can be eliminated by making up a small metion pump from a discarded becycle tire pomp, as abown in Fig. 4. The washer is reversed and an outlet pipe subtered on near the cap. One stroke of the pump will start the gasoline flowing steadily.

The spout should be attached to the pump barrel far snough from the end so that the plunger will pass by it and leave an unuspected path for the gasoline to continue flowing.

Use a New Gasket

WHEN you replace the cylinder head after scraping out the curbon, it is desirable to use a new cylinder-head gasket. If you are very execul in removing the

head the old gasket may not be damaged, but the salest way is to use a new gasket, and so avoid chance of leakage.

Irons Out Dents in Fender

WHILE it is possible to remove small deats in your fenders by means of a sand hag and a leather hammer, the novel device shown in Fig. 4 will grow them out

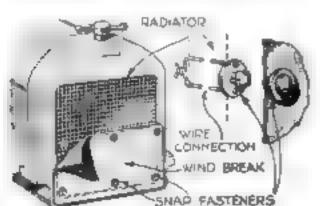


Fig 5. Snep-on radiator covers are out in appearance and eliminate danging Sape



Fig. 1. An ingenious way to improve tire from -the hooks hold the tire is place preventing it from slipping out of your grasp



Pig. 2. Simple siphon marker, made from a discorded buyele pump



Pig 1. Efficient lock for auto hood made of a piece of strap iron bent up and riveted to place



Fig. 4. This nevel device will Fig. 5. A notched choicer too out dents in your fender and proves a great convent without marrings the finish at all inner ou whater marrings

in fine style without damaging the finish. The frame is bent up from heavy from as illustrated, and fitted with a clamping bolt and two rollers of the type used as custers on factory hand trucks.

Strong brown paper should be placed between the rollers and the enameled surface of the fender. Pressure is mercased by turning the nut as the rollers are moved back and forth over the dent. Be

Ten Dollars for an Idea!

WELLS E. TUCKER, of St. Prince this month for his suggestion of hooks to improve the trons (Fig. 1). Each month Poettan Science Movement awards \$10 in addition to regular space rates to the reader sending in the heat idea for motorests. Other contributions that are published will be band for at usual rates.

careful to keep the rollers and the surface of the fender scrupulously clean, as a grain of sand or grit may cause the roller to slade and scrutch the finish.

Hood Lock Prevents Tampering

If YOUR car is stored in a public garage you will appreciate the advantage of locking your bood so that no one can experiment with the setting of your carburetor or tamper with the ignition. As shown in Fig. 3, a piece of strap from is bent up, drilled and riveted to the bood. The slot for the U-bolt can be made by drilling a row of holes and filing. The U-bolt should be bent up and riveted to the feature.

Notches Hold Choker Rod

On COLD mornings it is a musance to have to hold the choker rod out until the motor gets warmed up. If your car is fitted with a choke device that maps back when released, you can fix it so that it can be set at any desired point by fling a series of notches in the stem as shown in Fig. 3.

Snap-on Radiator Covers

SNAP fasteners of the type used to hold auto curtains in place are equally good for holding the radiator cover. They

can be applied at any point on the front surface of the radiator as indicated in Fig. 6. If you put in two rows and make two sizes of radiator covers, the smaller one could be used in mind weather and the large one when the thermometer gets down around the freezing point.

A Veneer Sun Vizor

Fig. 7 shows how to make a sample sun visor. Three-ply veneer is excellent, as it is light and warps little. After you have bent the brackets out of 14 by 14-inch iron, cut the veneer to the right size and fasten it in place. Two small strips of moking along the front edge, as shown will greatly improve the appearance, and dark green lacquer makes an excellent finish.

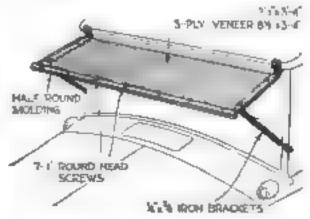


Fig. 7. A sun vasor you can make yourself out of materials that are not hard to obtain



CARNEGIE LIBRARY Hastings, Nebr.

Dear Sur

We burchased the NELSON'S LOOSE LEAF ENCYCLOPAEDIA In 1909 and have used it continually in our reference library. We find it thorough and complets and it is the only Encyclopaedia published which is up to date and can be continually kept up to date

THE RESEARCH BUREAU has from time to tune furnished ut special information for debates club papers, and other special information. We have always found this special information com-prehensive and unusually valuable when ice need special information

We most hearliby recommend NEL-SON'S LOOSE LEAF ENCYCLO-PAEDIA and Research Bureau

Sincerely, MRS. I. E. CAPPA, Librarian

An Encyclopaedia that is **ALWAYS UP-TO-DATE**

A few of the many advantages that you get in Nelson's

Loose Leaf Encyclopaedia

1 Nauson's is the enty Stendard Loose-Leaf Encyclopaedia. It is kept always new and up-to-date

Ten new packs nent to subscribers 2 every six months to replace the pages that have become old and out-of-date are a liberal education in themselves

3 Necson's Fire Reseason Library furnishes without gott oposiol information and scientific reports upon

NELSON'S READER & GUIDE, includ-4 ing thirty-three (33) study courses from Acconductor to Zoology, furnished

5 Nelson's special Index Volume of over 200,000 references, makes you sure of finding the exact information sought with a minumon of time and effort

NELSON & CONTAINS UPWARDS OF O 7.000 illustrations, text cuts colored pietes, charts, etc., and over 500 maps including each state of the Union and all the countries of the World-it complete Atlas

NELSON'S IS THE RECOUNIZED Standand American Encyclopsedas for Americans, used in the Library of Congress, U. S. Senate, U. S. Supreme Court, Libraries and Schools in every State.

O NELSON S, PUBLISHERS since 1798.

Ouriginated the Loose-Leaf Encyclopeedia in 1907—supplanting the old methods of encyclopsedia publishing

Atmost every great nation has its national encyclopsedia-France has Larousse: Germany Brockhaus, and so on. Nelson's Encyclopaedia is the representative, authoritative American Encyclopaedia. It is an American Encyclopaedia for Americans It is the recognized Standard American Encyclopsedia. It is

used in the linbrary of Congress, U. S. Senate, U.S. Supreme Court, and in Libraries Universities, and

Schools in every state in the

The value of an encyclopaedsa is dependent on its up-to-dateness. Because it is Loose-Leaf and because the pages that keep Nelson's Encyclopaedia up-to-date are supplied ready to be slipped into their proper place NELSON S ENCYCLOPAEDIA NEVER GROWS OLD—it lasts a lifetime

The importance of the loose-leaf feature of Nelson's Encyclopeedia is best illustrated by the fact that about 2,000 changes are made yearly

Think what this means to you-an Encyclopaedia to last a life time. Every encyclopaedia, except Nelson's, is out of date within six months after it is published. Nelson's Louise-Leaf Enevelopaedia is the only enevelopaedia that is always up-todate. There are no "new editions" to buy-it is always new! The set you buy today will be an up-to-date ten, fifteen, or twenty years from now as the day you

Every one has felt that he would we to own an authoritative encyclopacdia—many have hesitated to make the investment knowing that encyclopredies get "old" so quickly. But now you can buy a Nelson Encyclopaedia knowing that it will lest you a life time and always

be up to the minute. And you can buy a Nelson Eneyelopaedia for surprisingly little money

I has will find below a coupon that

book of beautifully illustrated sample pages including many pages showing 1listrations and maps in full colors. Also this coupon will bring you full derails about free membership in Nelson's Research Library Service Bureau and the Free Reader a Guide Service

Research Bureau for Special Information

Maring the coupant puts you under no obligation. May we tell you more about Nelson's Encyclopeedia' Why not mail the coupon today.







Who's seen the hammer and saw?

WHY have to search kitchen and cellar before you can start a job? You can make yourself a tool chest. It provides the simple and right way to keep your tools safely. They're always at hand when you want them.

Such protection justifies your purchase of good tools. And fine work requires fine tools. Most carpenters use Stanley Tools because of their superior material and design. The same characteristics make Stanley Tools the favorites in thousands of manual training classes.

A set of Stanley Tools provides all the tools you need to do the many repair jobs around the home—or to build a bookcase, a porch swing, a breakfast nook or other things you'd like to make, You can buy Stanley Tools separately and so collect your own set. And for your convenience in buying there is also a variety of sets. Assortments in strong cardboard boxes containing simple directions for making your own chest—ranging in price from \$5 to \$20. Or chests of tools from \$15 to \$95.



IMPORTANT: For only 10c (to cover cost of printing and mailing) we will gladly send you a plan sheet which gives full directions for making a Tool Chest like the one shown above. Ask for Plan No. 71—PS.

Ask your hardware dealer to show you the line of Stanley Tools. And send for our Catalogue No. 34 which describes Stanley Tools both separately and in assortments. Address: The Stanley Works. New Britain, Coon.

The best tools are the cheapest to use. Ask your hardware dealer



STANLEY TOOLS



How to Make Your Auto Look New

With Brushing Lacquers You Can Duplicate a Factory Finish By RALPH G. WARING

OTHER in timpensely pleased with the bequeres kitches." Dan remarked when he saw I had been analyzing a new brand of brushing lacquer.

That's good! What does she say about st?"

"She wanted me to tell you that this new finish seems to be easier to clean than the variush and enamel we used before, and the casters on the washing machine don't mark the floor any longer, either

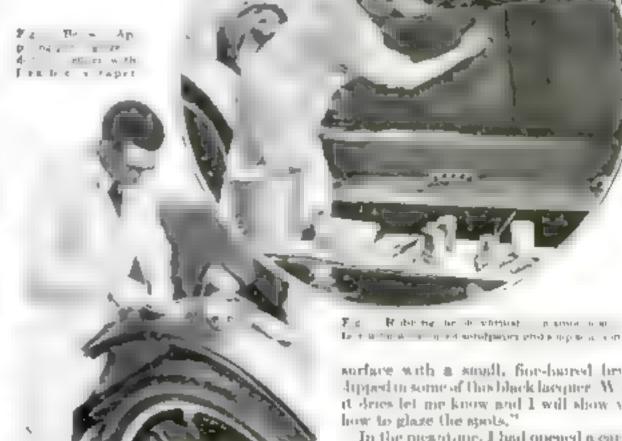
There is no doubt about the quality of these new finishes, Dan. I m tempted to try brushing becomer on the laboratory car. Look at that hig oluminum test maiel over there. Did you ever see anything finer than that? Of course, this brushing Incquer is intended for sutos. Some brands are and some area t, it a important to follow the manufacturer's recommenfinkon."

"How does it sand and rith?" asked Dan. It was evident that he had painful recultections of weary hours spent rusbing down finishes of one kind and another

"It rule meety," I assured him. "How's your muscle today? Do you want to dig in with me for a day or two



Fig. 3 Mr. Waring shows Dan how to protect nickel lens frames with breaking lacquer



and see what we can do with lacquer to the car? It will be fine experience.

"Lead me to it. I'd like to learn how to refinish an auto right

And so, with Dan's enthresasm and my knowledge of lacquer possibilities, we went to the garage to get things ready

I had had the car washed very carefully with chemical cleaners at the service station the day previous, after having explained to the operator that I wanted the car cleaned grease-free, ready for the paint shop. It cost a little more, but was worth it from our point of view

It so happened that the car, although secondhand, had the varnish in fair condition. There were no checks and only three or four chipped and dented places. I explained to Dun that it would be meessays to take care of these first in order that the special partix used might dry winle we were doing the rest of the job,

"Scrape and sand those places on the fenders with course paper and a knde. I told him "until you come to the bright metal. Dust off and then touch up the

surface with a small, fior-bared brock Apped to some of this black lacquer. When, it dries let me know and I will show you

In the meantains, I had opened a care of "spot-glaung putty" made for a no repainting stations. It is very fine and smooth, has tremendom adherence, and dries hard enough to sand in from one to two hours. With a 1-m, putty kinfe I put a spoonful on a piece of glass and then covered the can again to prevent the contents hardening on top. I worked the partly on the glass until it was smooth and soft, ready for use. Then I polished the onge of a 216-in scraper or glazing kinfe. of the flexible type on an orstone untuit was smooth and altarp.

BY THAT time the lacquered spots were dry so that we could glaze them by foreing the putty glaze into the holes. A quick firm sweep of the blade feathered out the edges and left the center plump and smooth. It helps a lot as the work if you back up the blade with your fingers Fig 1.

The left over putty was put back in the can and covered with water before the topwas replaced. That was to prevent the material from bardening unduly in the cas-

The day before (quiting on juge (0.1)

Once It Was an Old Was

HINESE Incquer entitles are to fashionable that I longed to have one. The prices seemed prohibitive and I felt as the little boy did before a bakeshop window, he might look and long, but dared not touch. Then I thought that some furniture is a matter of good proportion, lines, grace, beauty and restrained decoration, I should like to try naking a cabinet.

My desire settled on making a calainet similar to the Chinese lacquer existents so much an vogue in England in the early part of the eighteenth century. I have read recently that the prices for these calameta have sourced.

My imagination was fired by an illostration in Frederick Litchfield's "History of Furniture". This showed a cabinet in red bicquer with Chinese landscapes in gold and silver, mounted with engraved metal hinges, on a stand carved with a female mask, and decorated on the inside with foliage on a red ground

Quoting the author-" Within the last ten to fifteen years there has been in England a greatly increased appreciation of lacquered furniture. Cabinets of the square, boxlike form, having two doors opening and disclosing an interior arrangement of various small doors, now realize five or mx times the original amount—the red variety being that which is in most favor, In July, 1920, a estimet of this description mounted on a Chappendale incouered stand resoured 950. BRICKICAN.

NE friend took a kindly interest in my plans. When I suggested searching for an old piece of furniture for the upper box part of my calmet-to-be, she took me on a visit to her attic

Here I found just what I wanted in an old washstand

A formiture repair man we knew was glad to follow my sketches and put the piece in shape to decurate with lacquer in Oriental style. I had him take off the old drawer and add a straight piece at the back of the top and two small corners below to change the lower lane, which was too monotonous in effect.

I planned to use the cabinet to conceal a small, mahogany hox phonograph. The repair man placed the phonograph inside the embryo cabinet, after removing the shutter and cover of the box and making a new sounding board. Now It Is a Magnificent Lacquered Cabinet-You Can Make One Like It

By MARIE CHILDS TODD

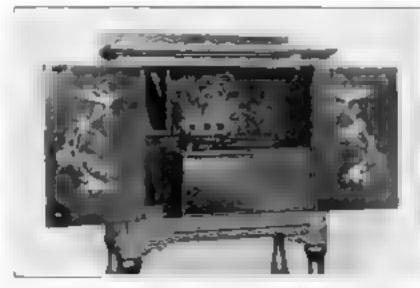


A Cabinet in Red and Gold

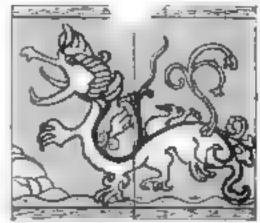
filles Todd teaches art in an Indiscopplis high echapt. Her design for the calcinet dust from in about above at the left, and an alternative Chinces dragon draign opposite

He bored a hole in the back of the cabinet so that the handle for regulating the machine would not be seen. He also made legs and stretchers of gumwood.

Such a calonet would house a radio set in regal splendor. It could be adapted espally well to serve as a writing desk by adding a drawer and a slale of wood, or it.



The interior of the othinet, which holds a phonograph, is finished. in black breaking lacquer with artistic flower designs in gold.



might be fitted with many little doors and drawers and, perhaps, a secret compartment or two intended for papers,

> My first work was to use paint and varnish remover on the old walnut. Then I sandpapered the wood thoroughly and applied a paste wood filler.

jewels and miscellaneous trinkets.

Meanwhile I had two pairs of brum hinges and a key-lock design about 5 by 5 in. made of braze 1/4 in, thick. The edges were designed like the notched margins of certain leaves. I sent my sketch to a brass foundry where they make made pieces, and engrave them, if one wishes. The lock and hinges cost about three dollars. I planned to treat the brass with acid and salt to give an antique effect. Of course, they would tarnul in time to give that effect anyway.

The principal design for ornamenting the cabinet was drawn freehand on paper and then copied on the cabinet. The basic idea was a deagon guarding the journey of the Spirit of Music and Harmony to the carth. I have sketched that so that you can solarge it for the

two door panels of your own exhaurt, or you may use a deagon design, which I have also shown, or make an original design.

USED a claylike material (it can be detained in actists' supply shops, called gesso to raise the design alightly above the wooden background, after I had used a transparent liquid filler or varnuh on the part that was to receive

> the gesso pattern. There are many ways of making and using gesso, but clear, simple directions were given in the April, 1986, issue of POPULAR SCIENCE MONTHLY in an article on page 86 entitled "Simple Handieraft Modeling." I put on the gesso with a patting motion, using the brush full and the gesso about the consistency of medium thick cream.

It is a process that is very ample, but must not be hurned. The work should be done evenly so that no patching is needed, as that is ant to cause cracks over the surface. If you must add to a spot, let the first coat set overnight. Use a little water to thin your (Contenued on page 80)

RCA-power Radiotrons VOLUME -without forcing

THE man who likes plenty of volume for easy strong usually has to drive the last tube of his set beyond its limit to get the music loud enough. And then it is no longer music. The RCA power Radiotrons are specially made to stand the strain in the last audio stage. They can handle plenty of volume without blasts or rattles, and therefore

mean finer, clearer tone

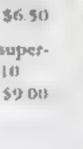


Dry battery power Radiotron LX-120 \$2.50

Storage battery of A. C. power Radiotron I. X-171 . \$6.00

Storage battery power Radiotron LX-112 . . . \$6.50

Storage battery of A.C. superpower Radiotron UX-210



THE RADIOLA



Quality is a research story

The high quality of performance violage with a gent ne RCA Radiotright is due to incessant research. The Radiorent apporatories muways to make better tubes—they had ways to improve manufacturing processes—and they keep a constant check on the uniformity of the manufactured Radiotron. It pays to look for the RCA mark

RADIO CORPORATION OF AMERICA Sav York Change San Fara San

RCA Radiotron

THE MAKERS OF

Aloft on Our Clipper Ship

How to Make Realistic and Beautiful Spars and Rigging for the New Model

By CAPT. E. ARMITAGE MCCANN

ET'S gather around the workbench and see what progress we are making with our model of the Sourcegn of the Sear. Only the hull is done, but what exquente grace there is in the flowing lines and sweeping curves!

Just to look at the bull is enough to convince one that the American clippers were the most beautiful of all the ships that ever sailed the seas. And, as certainly, no more graceful clipper evegraced the barbors of New York and San Francisco than the original of our attle model. She was a wonderful alop. the Sovereign. Let us hope our model. now so well started, will do her full

Perhaps you would like to build a model of this ship, yet missed the article last month in which the hull and deck fittings were described. That need not deter you because you can obtain full aree drawings of all the parts by sending 75 cents to the Blueprint Service Department, POPULAR SCIENCE MONTHLY. 250 Fourth Avenue, New York, N. Y. Ask for Bineprints Nos. 51, 58 and 53. (See page 97)

Now we can go ahead with the rigging (Fig. 1). First the spars will have to be made from dowel sticks such as are sold at hardware stores. If you prefer you can make them entirely by hand from any straight grained hardwood.

Choose straight grained dowels of sustable suce (two S-ft. lengths of be-us. dowels, one length of 14-in., and two of Mo-in.). The dimensions of the spars are

an shown full size on the rig-



Ship Model Blueprints

W If AT fince Obcodings gift can you imagine than a beautiful ship model." It is the sort of gift that grows in value with the rears. And you can build one with absolute assurance of success, for thousands of other Home Workshop readers have done it with the aid of our blueprints. You have a choice of there simplified ship mutel designs. a galler a Spanish gattern and a elipper See the list on page 97 from the scale drawing below (Fig. 2)

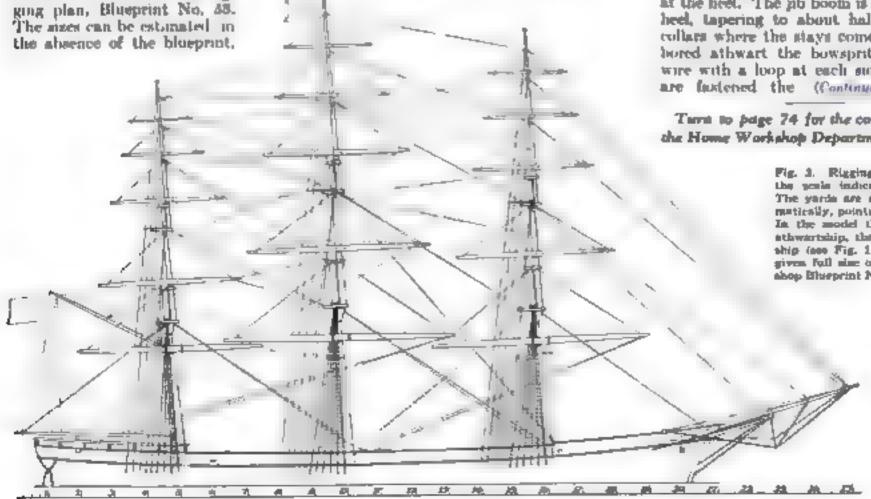
The main lowermust is the largest: each succeeding mast is a bit smallerthe fore, then the musen, then the topmasts, and so on. Each most tapers in stoelf very slightly.

The topgellant, royal and skymil maste are in one spar, the reduction in size forming a collar at the head of each. The lowerments are painted entirely white and the others white at the doublings and mastheads. In between they are stained a reddish brown with thin nurbogany colored varnuh stain.

The tapering bowsprit is a bare 16 in. at the heel. The jib boom is 14 m. at the heel, tapering to about half, with two collars where the stays come. A bole is bored athwart the bowsprit for a thin wire with a loop at each side, to which are fastened the (Continued on page 88)

Turn to page 74 for the continuation of the Home Workshop Department,

> Fig. 3. Rigging diagram with the peals indicated in inches. The yards are shown diagram. metically, pointing fore and aft In the model they are braced athwartship, that is, across the ship (see Fig. 1). This plan is given full sine on Moone Work shop Eliseprint No. 53 (page 97)



Instants - they have set a new standard of what a tuning control should be

BRAND NEW... yet it is already the distinguishing mark of a 1927 model receiver.

Such is the reception accorded the MAR-CO illuminated control by leading technical authorities and circuit designers everywhere

only by the widespread acclaim which, a year ago, swept 500,000 MAR-CO vernier dials into use.

Today * MAR-CO tuning is standard or optional equipment invirtually every important set-design of the season:

Cockedny's L. C. 27
Entirely MAR-COnuned, using the

Entirely MAR-CO-usued, using she alluminated control and 2 MAR-CO rheatest duta.

Radio Broadcast's
"LAB" Receiver
MAR-CO controls standard agripment

Radio News'
"Auto-transformer"
MAR-CO controls standard symposis

Popular Science's
5-rube receiver
MAR-CO dials standard equipments
Elementated controls optional

Citizens Radio Call Book's TRF set with shielded transformers MAR-CO controls standard equipment

St. James Super MARCO diel standard equipment

Radio World's
"Hi-Power" and Beacon Sets
MAR-CO controls standard agripment

Radio Age's "Super-9"
MAR-CO 360-degree dials standard
equipment

Daven "Hass Note" circuit MAR-CO dials standard equipment

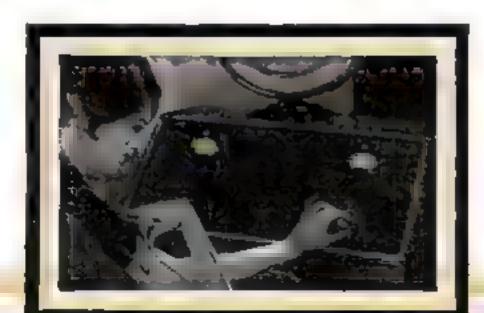
Hammerlund® Roberts, 1927 MAR-CO dials stordent equipment



MARCO

Alluminated

CONTROLS



The Radio Home's
"VARION" A. C. set

MAR-CO controls mandard aquipment

The "Infradyne" sponsored by RADIO MAR-CO costols aptional

The Ferrway

MAR-CO controls standard equipment

Ferguson
Single Control Receiver
MAR-CO central builds

Let this impressive list be your guide when you select the tuning controls for the new set you build, or the old one you remodel. ANY set can have MAR-CO tuning. Write for booklet.

Martin-Copeland Company Providence, R. L.



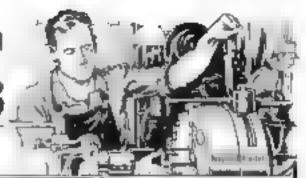
MAR-FO illuminated controls, complete with template, besel, and 6 Vok Marda lamp! Scales 0 to 100, or 100 to 0, 03.59

MAR-CO 2 tach rheustat dist (matches veruser dists to appearance)

6

Better Shop Methods

How Expert Mechanics Save Jime and Labor



Making Your Reamers Work Right

It All Depends Upon the Material You Are Going to Cut, the Tool You Select, and the Way You Hold It

THAT are you doing with these postone, Harvey?" asked Granes. He had been walking through the shop on his way to straighten out same production problems in the miling department when he had noticed several boxes of apparently finished pistons on the floor beside the lathe of his young friend, Harvey Smith

"Why, I'm fin sh-reaming the wrist-pm holes." Harvey replant, as he picked There are almost up another piston. three the sandths to be removed from each hole. I intended to ream them ->

hand at the bench, but I thought I could do it quicker by putting the reamer to a collet in the spindle of the lathe and bolding the poton in my hands," (See Fig. 1.)

Welt, I would stop right away!" snapped Grinies. "You can never tell what you are going to get if you go at the job that way You may speil a lot of valuable work."

"I don't see how," protested the startled lad. "I'm only using the lathe to drive the reamer instead of doing it by hand. What difference does that make?"

"Don't you see that you are likely to get an elliptical hole, or one that is 'bell-mouthed'?" and Grimes. "You cannot hold the puston so the reamer will follow the hole accurately, and you are apt to force it.

or bear on a little too hard and so produce an maccurate hole. If you ream them by hand at the bench, the reasure naturally follows the hole without forcing no that you get an accurate job."

"EE' I never thought of that," ad-J mitted Harvey. "I guess I'd better come up to your house, if you'll let me, and learn a little something about resmers."

"All right. Come up about seven thirty. and bring your notebook."

When Harvey arrived at the engineer's home that evening, he plunged into the

subject immediately. "I want to find out all there is to know shout reamers, Mr. Grimes!" he declared. "That's rather a large order, Harvey."

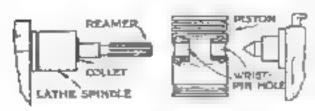


Fig. 1. The method Harvey intended in use for truing wrist-pin boles in the pistons

By ALBERT A. DOWD Conrulning Engineer

laughed Grimes. "It would take more than one evening to give you all I know about it, and much of it would be unnecessary for your purposes. What you need to know is how a reamer works, how it should be used, and what kind of a reamer to select for different classes of

"hes, that's just exactly what I'm



Stop right away?" enapped Orimes. "You can never tell what you are going to get if you go at the job in that way"

After " Harvey replied enthumastically "Primarily, a reamer is a manig tool." the engineer began. "It is intended for use in a bole previously drilled or bored very nearly to size. A good way to think of a reamer is to compare it with a boring tool as it would look in a hole, like this

"Here at A, we have a boring tool, C. removing the metal in the hole, and at B we have a reamer. D. also removing

sketch (Fig. 2).

metal. In the boring tool we have a single point in contact with the metal, so that in feeding through the work any hard spots or imperfections in the metal may cause the tool to spring away and thus change the size a trifle. In the reamer we have six or more teeth all cutting together, each one removing only a small amount of material. The reamer has an eight-point bearing distributed undormly around the made of the hole so it cannot spring away as does the borng tool. Therefore, it is much more likely to produce a true cylindrical hole of the correct size. Is that

dear. Harvey?" "Why, of course. Any mechanic knows that without all this explanation," the young mechanic assured lam nomewhat impatiently, "You don't need to give me a kindergarten talk."

"Well, I disagree with you there." retorted Grimes, "If you know all that, why did you forget first principles when you began to ream those pictors this morning? If you had stopped to think of the cutting action of the reamer you would have known that a little more pressure on one sale of the paston than on the other would make the reamer cut unevenly and give an elliptical hole as in this sketch." (F in the view E, Pig. 2.)

I guess you are right," acknowledged

Harvey "I see the point you are making "
What I am trying to do,"
Grames went on, "is to get you to
think for yourself. You have a head on your shoulders and if you will stop a moment and think of the cutting action of your tools when yau do a job, you will avout making blunders.

> "TO CONTINUE, when you have an accurate hole to make and you know you will have to ream it, think of three things: First, the nature of the work and the material you are going to out, second, the way you are going to hold the reamer; and third, the kind of reamer you are going to

Each is a factor of importance. "Why does the kind of material make much difference?" the lad inquired. "Reamers are all pretty much the same, aren't they, when used for straight holes? Of course, I know there are regular hand reamers and rose reamers, but they cut about alike, don't they?

"Let's take one thing at a time," answered Grames. "First, the nature of the work and kind (Continued on page 195).

ANY time-taving thop ideas are M contained in the continuation of the Better Shop Methods Department, to be found on pages 119 to 128.

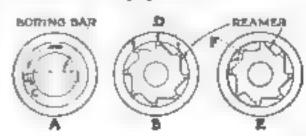
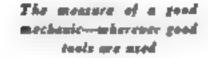


Fig. 2. Comperison of buring (A) and reaming (B) a reasser cutting an elliptical bole (B)

t last a steel tape that is genuine stainless steel





TERE, at last, is a steel tape that won't rust. Carpenters. builders, contractors, surveyors, mechanics - everybody who has used steel tapes knows how often they have to be scoured and what scouring does to a tape.

But this tape con't rust - it's made from genuine Stainless Steel. Use it in mud and water as much as you like - and then wind it up and forget it. It won't rust or stain, it will never need scouring or cleaning and the graduations will be as sharp and distinct after years of use as when the tape was

Made in 50, 75 and 100 ft. lengths of genuine Stainless Steel; graduated in feet, inches and eighths of an inch or in feet, tenths and hundredths of a foot. Quick reading figures—the foot mark is shown in a different size figure before each inch mark. Has leather case and push button handle. Ask your hardware dealer for Starrott Stainless Steel Tape No. 520.

You also get these same fine non-rusting qualities in Starrett Stainless Steel Rules, 6 and 12-inch lengths, hardened and tempered, and in 6-inch lengths flexible - graduated in 8ths and loths on one side and 32nds and 64ths on the other.

If you're interested in fine tools, write for a free copy of the 352 page Starrett Catalog, No. 23 "W"

THE L. S. STARRETT CO., ATHOL, MASS. World's Greatest Tool Makers Steel Takes - Standard for Accuracy

Starrett STAINLESS STEEL Tapes and Rules

Gennine Stainless Steel is manufactured only under the potents of the

AMERICAN STAINLESS STEEL COMPANY

Commonwealth Building, Pittsburgh, Penna.

Starrett Dealers are

displaying Starcett

Stainless Steel Tubes

and Rules the week of Ocs. 9th-look for "the measure of a good mechanic" in

your dealer's min-

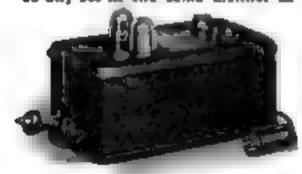
dose.



Deep resonant bass notes-vibrant high notes-All clear as a Bell

P YOU like music you will want an Aero B Amplipower on your radio Lustrument as clear and full toned as the instrument thell. It makes any ser a real musical interrment, reproducing the deep mellow base notes that have heretafore been insudible on practically all radio sets.

The Aero B Amplipower not only Improves tonal quality and increases volume but also supplies all of the "B" current for the see. It is sensched to any set in the same manner as



"B" betteries, with an adapter plug which is inserted in the tube socket of the last audiostage of the set, replacing this tube with the highvoltagepowertube in the Amplipower.

You wen't know made on your radio set until you use the Amp spower - peace \$65.00 without tubes,

Acro B is also bross high voltage pow-\$30.00 complets.



THE GLENN L. MARTIN COMPANY Radio Division Cleveland, Ohio Cleveland, Ohio



How to Get Best Results from Our Five- Tube Set



Exact Balancing la Important

A piece of wood with p forhed porch can be used to turn the knurled knot of the balancing gradenser A The knob can be turned with the fingers, but the wooden stack elimenates hand capacity effects and makes it easier to find the correct setting

By ALFRED P. LANE

NSTRUCTIONS showing you how to build and wire a powerful five-tube receiver appeared in the last issue of POPULAN SCIENCE MOSTING, and blueprints Nos. 34 and 35 (see page 97) give this same information in even greater detail.

If you have completed the receiver or you are thinking about building it, you will want to know what tubes to use under various conditions, how to balance and tune correctly, and other details that will help you to get the best results. This information will prove meful, besides, to all residers who own radio sets of the name general type

Everything considered, the best arrangement of tubes when you are near a number of broadcasting stations is a 2014. type tube in each of the first four sockets. MI M M Jand M Landa 171 type tube in the last stage amplifier socket M5. To get full power and the finest quality of reproduction from this combination of tubes, you will need a B-hattery that will give you 180 volts. This voltage can be obtained from four 45-volt batteries connerted in senes. In addition you will need another 45-volt battery to supply the proper C-battery voltage for the 171 tube and a 414-volt C-battery for the rest of the act.

The B-current will be about 15 to 16 instrumpered, so if you buy the heavyduty type B-batteries you will get about a year's bervice before they need replacement. A medium-sized 45-volt battery will do nicely for the C-battery, as the current drawn is exceedingly small. In fact, the smallest use of battery is large enough to take care of the current, but the very small batteries of the portable type are not recommended as they go had after a few months even when no current is drawn from them.

The 112 type amplifier tube can be used. on place of the 171 type, but it will not give you as good quality if you want plenty of volume. It is, however, a more evonomical tube to operate because it tion considerably less current from the Bbattery. On weak agnals, it also amplibes more than the 171.

With the 112 tube, use 15714 volts of B-hattery and 9 volts of C-battery. This voltage can be obtained from three 45volt batteries and one \$314-volt battery connected in series. The current drawn by the whole receiver when the 118 tabe is used in socket M 5 is only 8 milbamperes, so that the medium-sized B-batteries will last about a year. These batteries cost less than the heavy-duty size needed to supply the large current when the 171 tube is used

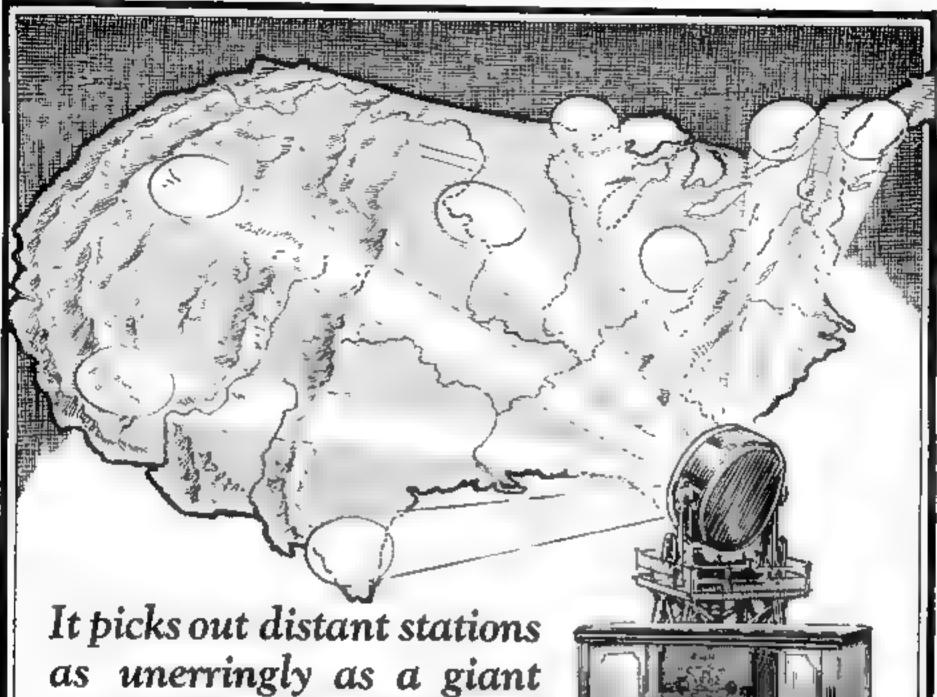
The receiver is designed for use with storage battery tubes, but if you find it necessary to use dry cell tubes because you have no way of charging a storage battery conveniently, you can get sainfactory results with the three-volt dry celltubes. Put a 109 tube in each of sockets MI to Mi and a 120 time in socket Mi. Put a relf-adjusting rheortal size 4 V-100 at St. 54, 83 and 84 and a self-adjusting. rheostat sige 120 at 85. I se three 45-volt. medium-sized B-batteries connected in series to give you 195 value and a 2236-volt Chattery They will last about a year

THE above mentioned B-voltages should be applied to binding post No. 11 and the C-voltages to bending post No. No matter what tubes you use, always. apply 90 volts to binding post No. 10, 45 volts to binding port No. 9 and 414 volts of C-battery to binding post No. 6.

Lower voltage can be used on hinding post No. 11 with a corresponding decrease in volume. Be sure to reduce the Cbattery voltage applied to binding post No. 7 until the quality seems right if lower B-battery voltages are used

Modern types of B-chimnators can be used up place of batteries with satisfactory

If you are interested in bringing in distant stations or (Continued on page 112)



searchlight finds its mark

And with a quality of tone that
is a revelation to radio listeners

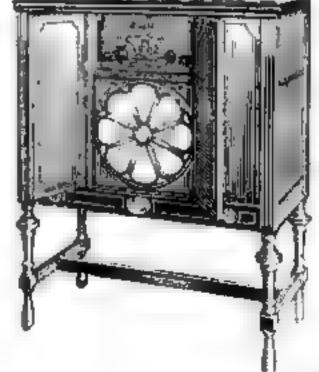
THIS new STRAIGHT "9" NINE is a set that will give an owner complete satisfaction in cities and other congested broadcasting areas. It goes through locals, when they are at the height of their broadcasting, as though they did not exist, bringing in remote stations with remarkable clarity and volume

Every Straight "9" Nine is builted by 14 years of experience in RADIO and an established Prints repotation for volve, performance and quality.



"Outstanding radio performance and value on the market today — without exception"

PRIESS RADIO CORPORATION
693 Broadway New York



Nina Tunes... Local Organization
Amazing selectivity. No interference.
No background noises.

A superabundance of power, that mourts tremendous distance

Single dial control. Direct reading wave length.

Centrono, \$335 Tanta Messee, \$195
A bone demonstration by a Prices dealer berefore on obsegution. We'll send you has make on request

Distributor Demonstration

Write or wire at once for dealer reservision subject to demonstration

AFTER workshop in 4 by 7 Feet Revember, A Workshop in 4 by 7 Feet Results Revenue Say "I Have No Room for a P By Enter By Enter AFTER workshop in 4 by 7 Feet Revenue Revenue Room for a P By Enter AFTER workshop in 4 by 7 Feet Revenue Re

The wise mechanic hitches his cutting problems to the Star Hack Saw

He knows through his years of experience that this blade has always been the leader in cutting efficiency.

The new Special Flexible Blade combines flexibility and cutting qualities that you have never experienced in other blades.

WRITE FOR FREE SAMPLE BLADES

Clemson Bros., Inc. Middletown, N. Y.

MAKERS SINCE 1883

STAR HACK SAWS



Untskill Mountains of New York

was to make decorntive furniture fit tings in metal.

When I arrived I found that there was little or no metal working equipment save a forge in an old herhouse, together with an anvil and such tools usually found in a farm repast shop. woodworking, potbery and other shops. however, were completely. equipped with modern machine and hand tools.

With the hunted component at hand I started work. I had to make many of the tools I needed at first, but the work went on and soon out grew the little red shop. A second and much larger shop was then fitted up with many more tools and a real brick forge. Finally the work outgrew this sessond shop and we built a new shop such as I had long dreamed of working in -one with a gasoline engine for power, an engine lathe.

Here was a wonderful life and contact

with all sorts of stalled craftsmen. artists, writers, sculptors, musiciana weavent, pollent.

Then came the cali to tench decorative metal working at Commbia 1 m versity, under my old friend and teacher Professor Arthur Dow who had already been teaching there for severayears. For over fifteen years I taught in the University. and to teach, one has to know, and to know, one has to find out and though

I had load considerable shop training by this time, it would have been napossible for me to teach if I had not had my own

shop at the same time.

About this time I built my first large shop, in the back yiel of our house at home. The power was furnished at first by a steam erg ne with an oil fired boiler. as gassime engines were not as mexpengive and depend-Continued on page 81,



Fig. L. In this tley shop, Mr. Thatcher inrented tin and toys and ded a variety of work

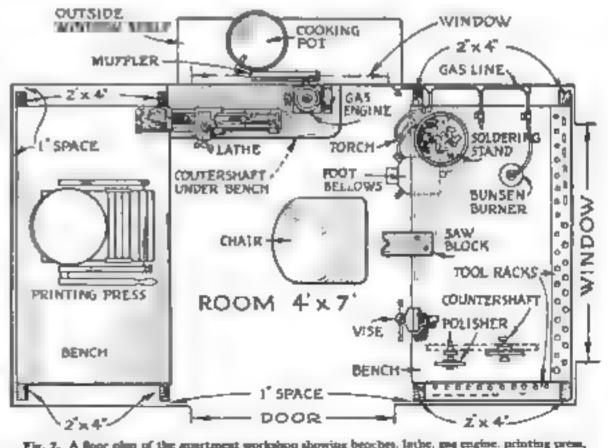
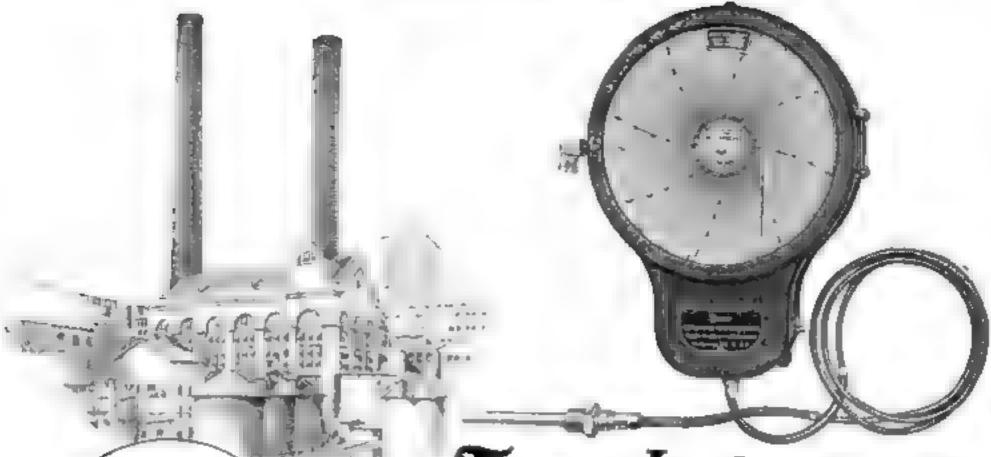


Fig. 7. A floor plan of the apartment workshop showing beaches, lathe, gas engine, printing years, and other equipment. Note the ingenious method of avoiding damage to walls and woodwork



Tycos- for the

and to promoting human e belency

From Both Thermometers To could you to get the most good from your back.

Birder Home Set

Bake Oven The mometer, Candy Thermoreeter, Sugar Meter The secret of accurate results in cooking.

Popu Wall Thermometers To help you maintain a temperature in your house conductive to good health

Andr Quality Companies To show you the tight WAY TO BUTAINS TAY **COuntry**

From Fever Thermometers A necessity to every

Sees Surmagaids

Forecasts the weather twenty-four hours shead with dependable accuracy

Free Hygrameter

To enable you so keep the humidity of the ormosphere in your home correct of all Di Divers

Your dealer will show them to you. Ask me, on a poster, for bushlets on any of the above





Four Sphygmomanometer, Pocket and Office types

> Rives Urapalyans Glassware. See Fever Thermometers. Belletter on request.

Tycos Instruments Insure Economy for the ROCHESTER GAS AND ELECTRIC CORPORATION

Says R. D. DeWolf, Ass't Superintendent-

66 CIN these times efficient boiler operation requires a complete knowledge of what is taking place in all parts of the plant. For that reason we installed Tycos indicating and recording instruments in our boiler room

We have recording and indicating thermometers on our steam lines, some of which are as an feet more bessee the instruments are at both ends of the steam line, they indicate the I are losses which manifest themselves as a reduction in the superheat. This enables us to direct taulty line insulation, and their save pur coul bill. The indicating thermometers on the feed water meet dum whether the economizer is duing enough work - they detect dirty economizers and prugged up lines. The recording thermometers memoring flue gas temperature are a great a on the efficient control of drafts. Indicating thermometers are used on our steam outlets from the superheaters. For determining the vacuum in our conseniers we use the Tycos. Thermo-Vacuum Gauge which gives the absorute pressure in inches.

"All Typos" recorders give continuous or bourly records—the only type of records that can produce maximum efficiency. While our Typos equipment is very complete the investment is small compared with the savings effected. We couldn't operate economically without auch equipment

Tyeos increments live up to the high standard of Rochester made means quality in EVERY PEOPLE

TO MANUFACTURERS

If our marries were reduced to endouring it reduces in moraling of properties there is a type and trylo of entruser. To 7 in the 4500 level of the months of the properties a filterature of any expert of photograph will be the first properties of regions of the expressions are also as the approximation of Treat to your retriction manu-Carriery processes

Taylor Instrument Companies

Male Office and People's

ROCHESTER, N. Y. . U. S. A.

des Photo See BUILDING, TORONTO SHORT & MASON, Led., Manufacturing Distribution in Greet Britaln

THE SIXTH SENSE OF INDUSTRY

Tycos Temperature Instruments





Reduce your coal bills 20%

—and increase your living space

HERE'S a new way to cut 20% to 30% off your fuel bills.

And add valuable living space at the same time!

Line your anic and cellar with Upson Board.



In your attic, apply the big panels right over the rafteral Then ould in partitions—an attractive room for the maid, a useful storage room—valuable new living space to replace "old cobwebs."

Upson Board beneath the floor boards to eliminate drafts and dust. Then partition in the furnace to keep coal dust out of the house. Build in a cellar laundry, fruit closet, other valuable rooms.

You know about Upion Board, of course It comes in a glumber-like panels, group—yet so night one man can apply them, even on coungs Goes directly over at ids and joints—or in remodeling, right over old cracked plaster.

Impartial laboratory tests prove Upson Board from 40° o to 150° o stronger than other fibre and planter-filled boards tested—fire and mossive retarding.

It is approved by use in over 500,000 buildings. Try Lpson Board for your action—or to cover just one cracked ceibing. You'll like it! We invite you to mail the coupon below for sample and blue print.





PROPERTY.

WAME

ADDRESS

(\$10,15 mire; 51/2) 13 1 10,00

A Kitchen Cupboard on Wheels



By EDWIN M. LOVE

BECAUSE it is mounted on swivel wheels and may be moved easily from room to room, the kitchen cuplicard illustrated is useful in small houses where cabinet space is limited. When not in use, the cuplicard can be wheeled into a corner or pushed onto the back purch out of the way, and when needed it can be drawn up beside the drain board to receive the dried dishes.

The over-all dimensions (Fig. 1) are I ft. B in. by S ft. by a few inches more than 4 ft., the height varying with the

style and size of the wheels.

The four corner posts are of 2 by 2 in, fir, pass or other soft wood, used to 156 in, equare, and cut to a length of 5 ft. 1136 in. Mark the two outside faces with an X to distinguish them, and lay them out as follows:

Groove the left front leg. 1/4 in from the face, 3/4 in wide and 5/4 in deep. Beginning with the top edge, square lines across for the mortise ends as dimensioned in the detail in Fig. 2, and gage sale lines for all 1/4 in from the front edge. Unge 3/4 in back of this line another for the back edges of the mortises for top, bottom, and countershelf rails.

Dig these mortises by in deep, either by boring out with an auger bit and trimining with a chisel or by chipping entirely with a 24 in chisel

Cut the lower top door rail mortise and drawer rail mortises \$\frac{1}{2}\$ in, deep from the front gage line through the width of the post. Be quite accurate as to depth, since the cabinet being designed for lightness, must depend on comparatively small points for rapidity.

LAY out, in a similar manner on the grooved side for the top and bottom panel rade, and make these mortises 1% in, deep, which, of course, makes them angular continuations of the front rule mortises. The three narrow rail mortises are cut % m, deep from the back face to the groove.

Saves Space and Steps in a Small House or Apartment

Grouve the pairing back post and make corresponding tail mortages % in, deep. To receive the back, rabbet the back edge % in, deep and % in, wide. For a guide in assembling with the sheives, mark the positions from the front post.

Make the other posts as pairs with the first.

The upper panel rads (Fig. 3) are 36 by 2 in, by 1 ft. 7 in, grooved 36 in, by 36 in, at a

estance 14 in, from the face sides, and notered on the front ends. The lower rails are the same, except that they are 2 by in, wide and have 14-in, didoes 14 in, deep, cut 8 by in from the square ends.

Three-ply panel veneer *g in thock is used for the panels. Cut 18-in, widths, 5 ft. 736 in, long, apply glue to the edges, to the post and rail grooves, and to the mortises and rail unds, and assemble, clamping the posts straight and square.

While the sides are drying, get out the other parts. Make the upper top door rail 36 by 8 in, by 8 ft, 1134 in, with both ends mitered as detailed (Fig. 2). Mortue in the center of the back face 14 is, deep, to receive a lap tenon on the month 114 in, wide and 114 in, long. Make the bottom front rail the same, with the mortue in the upper edge.

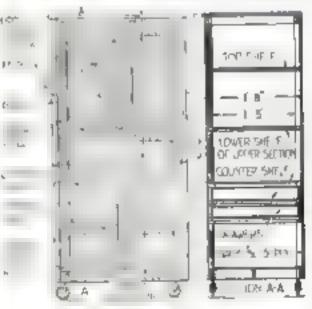


Fig. 1 The portable hitchen cabinet, shows above, is light as well as strong.

CREAT BROAD CASTING STATIONS LISTEN TO THE BROWN PROGRAMS WILL DAY FAN LALIO RECLEVES

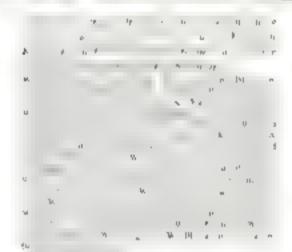


So when the Big Broadcasting Station of the Calumet Baking Powder Co. and "Rainho Gardens," Chicago, wanted to judge the quality of their own broadcasting, they installed a

CANAY-FANGS

The second of the property of the second of the property of the rest of the re

I us that a kill taken is wife a sproval of the Day La. Restore, on so the receiver which was best to perfect when I were to a first to first all star one at their newspiper thankers. The ropublish its own Air Telephone Direct its and with the six, a disease to the sets from Say it say addge Day-Fang not as a rando out as a great musical insection.







Do Away With Local Interference

No, not all the horse in your radius is saved by static. Most of et a lettal, caused by your pour small bousehold appliance more changes the hoose order. These natives go direct to time set, spent your extertainment, and get blanded as sets.



Quarties, which is has testificing up the worth the set street in a Day Fan as governor which sorps these recess before their reach your set.

Improve the classify of your receptants—write as for information on Quie

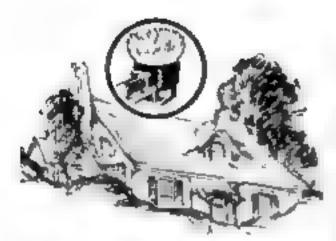
Mode from alternated in the groups aparament in February pump electric refrageration are Price 570 to We also have Made both for home high ingiplants. Price 10 to.

Day-Fan Elemer Co., Dayson, Ohio. Digit, P. S. a. Too may send one information regarding Day-Fan Radio and address of matters dealer

Name.

diling

State



\$3,127,461

in 60 days invested by home owners in the

New Silent NOKOL

AMERICAN home owners are now investing in the new Silent NOKOL, at the amering rate of \$1,500,000 monthly— \$3,127,461 in 60 days.

To NOKCL efficiency and accoomy has been added the final development in an hear—Silence.

Noise has been cut to the unnishing beint. Comfort almost unhaped for has at her become a reality.

loverigen the new Stlent NOROL now. Don't regard it as a high continuous High effectioney, which for new years post has enablished records for lowest cost, fully automatic att heat—is now arountly increased.

Set your thermostet for the dustred heat—NOKOL does the rest. You get comfortable, healthful heat, automatically—and you get it without dirt or dust or trouble.

There is no oder—either inside or outside the home! NOCOL provides low-cost heat without using a low-grade fuel of.

You can find out all about the new Sident NOKOL in 10 or 15 minutes at about rooms. There are now more rooms heated by NOKOL thanby my other automatic oil heat.

A NOKOL can be inscalled in your home now-on movement terms.

If unable to come in, get the faces, together with an interesting book on oil hear for horses, by mailing the coupon.

NEW Silent

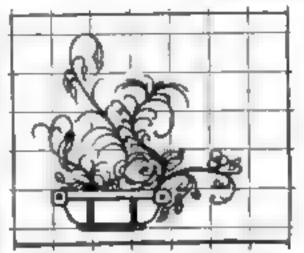
AUTOMATIC OIL HEATING FOR HOMES

FRBB	— N B 7	у воо	K
AMERICAN :	NOKOL CO	MPANY	
Plane med per			•
Name	m		
Address			
City.		State .	

الأركان مراع عربي ١٤ عدد الله

Once It Was an Old Washstand

(Continued from page 68)



This design, in gold on black was used for ornamenting the back of the cubmet

gesso composition. After it hardens, it may be sandpapered with 00 sandpaper, or may even be carved a little with small chisels, but for a less elaborate design this process is not necessary.

I mused the dragon, boat and canopy of flowers a trifle higher than the Spirit

of Music part of the motif.

The process of raising the design in gesso is as fascinating as wood carving and much simpler. I allowed the gesso to set for several days and was fortunate in not finding a single area of cracked surface. Then I sandpapered the design to remove any rough places.

Before painting the surface of the raised design with green gold bronze, I prepared to give several coats of Chinese red lacquer to the cabinet. For this purpose I used one of the new brinshing lacquers. Some may prefer a black and gold or a dark green black and gold color scheme for their cabinets. Any of these color harmonies are correct from the standpoint of fermiture history,

I'se a new bouse-paint brush about 5 m, wide and flow the lacquer on swiftly

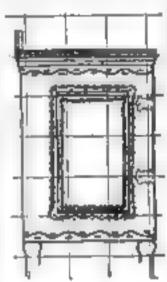
with an even pressure on the brush. If there should be a slight tendency to rapple, such defects are readily corrected with a second coat, which may be applied within an hour. The following day a third coat is applied.

The next step was the application of green gold to the design itself, that is, to the

gesso. The green gold, which comes in powder form, is mixed with an oil medium this can be obtained in paint and art stores of any size—and should be stored constantly and kept medium thin—a little thicker than water. The gesso surface, though slightly rough, takes gold preparation perfectly if it is applied with an ordinary soft camel's-hair brush, such as is After the gold surface is dry, other colors are added for accent or contrasting color harmony. On my cabinet I used accents of black lacquer and cerulean blue on paint, which softened what night have been a bisarre color effect. From the dragen's bead float painted sprays of cerulean blue and gold flowers and leaves.

On the front I also applied the blue and gold in bands as backgrounds for the bor-

ders. My idea for the border designs was a line and spot repetition, auggesting waves and foam fleckiron water. This is repeated in a 2 m. wide border just below the two door panels and has a cerulena blue background with gold wave and spot pattern. Theother anualler barders on thefront of the calmetare blue wave and spots on gold backgrounds. The



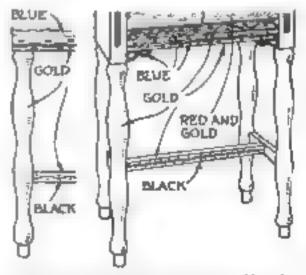
Wave and spot designs on side of the cubinet

borders vary on width from 14 to 2 in. They are used on the sides of the calquet and histrated on this page.

The 3 m wide upright strip at the back of the calmet on top hou a gold background, which partly conceals and partly reveals the rea lacquer. On this the wave border is partled in black. This treatment is repeated throughout.

Later, to lighten the solid effect of the red lacques on the front, I added a few touches of Chuese vermion on paint and, after this had dried for several days, brushed in an irregular line pattern in gold to suggest the edges of clouds in the red background.

The interior of my cabinet is finished in stately black lacquer and gold designs. To the left, beside the phonograph box, which has been transformed from polishes makegany to a black inequer finish, there are four upright (Continued on page 81)



The legs were finished in green gold and black lacquer: note coloring of borders

Design for the inside

of each of the doors

When it's hunters' day at the horse show—and the best jumpers in the land are soaring over the hedges —have a Camel!



No other eigerette in the world is like Cemels. Cemels contain the charcest Turkish and Domestic tobaccos. The Cemel blend is the triumple of expert blenders. Even the Camel eigerette paper to the finest—made especially in France, Into this one brend of eigerettes is concentrated the experience and skill of the largest tobacco organization in the world.

WHEN it's the most exciting day at the horse show, When the famous hunters take water jump, wall and rail in faultless performance—have a Camel!

For, all the world over, no other cigarette cheers and satisfies like a Camel. The golden enjoyment of Camela makes every happy holiday happier, adds the sense of well-being to every friendly occasion. Camela are made of the choicest Turkish and Domestic tobaccos grown—they are the cigarettes that never tire the taste, never leave a cigaretty after-taste. Millions who could well afford to pay more will smoke only Camels.

So as you join the gay throngs at the horse show. After each thrilling event—know then the enjoyment of the finest in eigerettes.

Have a Camelt





Our highest with, I row do no vet hunter Camel quelity is that you ten them We made not them pure Camels with one other reporter made at any price.

R. J. Reynolds Tohasen Company Winston-Salem, N. C.

New! The



Now you can build models in colors!

You've never seen anything like it, follows' Look at the beautiful models on this page with their astrons coloring—all made with the new Multi-rotor Mercano. Part after participants with the fine engineering quality for whole Meccano has always been lamons, as star there.

We wanted the best colors we could find so we selected Directifier same generic Doco that is used on the latest automobile bodies you is probably find it on Dad's new car. This gives a hard tile, we finish that does not crack or pechtike orchary paints. And Durochnisae i parts connot not.

Get the newest thing in construction toys Building with Mer and prilend easy. No stady required their your models in leight colors. In a ug real for the Fore Figure of the green for the Tank Car, only Multi-color Meccano gives you this, yet it costs no more.

You'll certainly give the gang a surprise when you display your apple-the mainte Multicoler outfit. No more colorless, dull models for you — be a leaster! This is the day of the new Multicolor Meccano.

There are sets from \$1,00 to \$15.00. Two dandy specials at \$5 and \$10 include motors. See them at your dealers.

Send for this Free Book

It's an interesting story entitled. "How Jack Discovered the Perfect Toy." It will tell you aid about the new Multicolor Meccans. Sent free for your name and address and those of three of your chims. Put No. ket after your own name for reference.

MECCANO COMPANY, INC., Eksabeth, N. J.

In Canada: Meccano Lid., 45 Colborne St., Toronto



The Special \$5.00 Outfit

Contains the powerful Mercapo electric motor and parts and full anstructions for building more than 100 models. Sent prepaid upon receipt of parce of not at your dealers.



THERQUALITYTOY

Once an Old Washstand

(Continued from page 90)

record compartments made of wood. On the maide of the back is a flower arrangement done in green gold. On the usade panel of each door are tall, slender hily designa in tiny bowls, drawn with free brush lines after the Chinese or Japanese fashion. However, these are not reproductions of any art, but children of my own, fancy free.

If you wish to copy these designs, you may out paper to the ause of the spaces you wish to decorate and, after practicing changing the proportions to suit your space limitations, transfer your design either by chalking the back of the paper or by placing yellow carbon, or majoresaion paper, against the wood and going over your pattern with a medium pencil with a sharp point. The advantage of chalk in transferring the design to a dark background with a high glaze is that it may be readly seen and yet all traces are easily removed when your work is com-

pleted. Last of all Lapphed two coats of flat. varioth, which dries duly and does not require rubbing, although polishing gently with a soft each adds to its soft toped

This calinet makes a piece of furniture that would grace any hiving room or studio. If Chinese red is used, care must he taken, of course, in placing paintings or prints nearby on the wall so that they will be subordinate in color to the beauty of the calonet

A Shop in 4 by 7 Feet

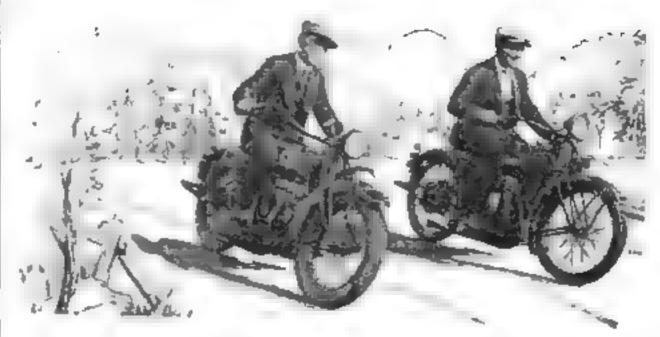
Continued from page 26

able as they now are. Of course, I had a whastle on the shop. I remember very well putting this on the roof. It was all connected up one morning about eleven a'clock and I blew it. The boiler pressure was considerable and the whothe was heard all over town. The housewives in our neighborhood all got dinner an hour before any one came home to eat it, and I heard from them and from the town counc l

In this shop the line shaft drove my first screw-cotting cagone athe, a much se-I had dreamed of owning for years. There was a power-driven granding and poleshing head, post drill, forge, blower melt ng furnace, grindstone, plating dynamo. enamel furnace, and so on. Much of the shafting and pulleys came from the junk yard, and I hudt a good deal of my own equipment, as I still do.

SOMETIME later, while still teaching at Colombia, I married and we set up housekeeping in New York. One of the most sunusing and practical shops I ever had was located in the rear of our apartment. This was in a small room exactly 4 by 7 ft. in size, but it did have two very large windows. This was back of the krichen and overlooked a courtywel.

While I still kept my larger shop at home in the country, I did practically all my lighter work in this tiny shop in the city. It was always (Continued on page 99)



Two Famous "Pals"

who cut the heart out of travel cost!

TP you want to travel for less than car-■ fare—if you want the kind of convenience and dispatch which gets you there earlier and back sooner-if you like outdoor sport that packs a big "kick"-hop on one of these fumous INDIAN "pals." You'll know the real meaning of motorcycle convenience and pleasure.

Motoring at its best

You'll understand what perfect balance, quick, smooth start and lightning-like pick-up mean to the solo rider in heavy traffic. For long-distance touring you'll find at your finger tips all the speed you'll ever be able to use—all the power you'll ever need. In a word, you'll know motoring at its best! At a fraction of carfare cost—a cent a mile or less.

Easy to own—investigate

Visit your nearest Indian Dealer, Let him demonstrate the Indian Prince and the Indian Scout-the two "pals" that cut the heart out of travel cost. Let the Indian Dealer tell you about his pay-as-you-ride plan that makes it easy to own an Indian. The coupon below brings you—free—our illustrated catalog. Mail it today for the complete interesting story of these two famous models.

Lowest initial cost ! Lowest upkeep! No garage bills! No traffic delayal

Indian Prince

The Solo Single

Easier to handle than a bile You ran lean to operate it in 3 minutes. Cleans recepent half on high. Speeds no 50 miles per hour Turns to 7 foot circle Low haddle Three speed imageomission. Two unit electrical system. Light in weight, jet stuide in ton-structum. 90 miles per ga lon gas, Less than Ic per mile operating a nu. Price with complete electrical equip-ment \$223.00 F.O. B. Springfield, Mass.

Indian Scout The Sulo Twin

Twin-celinder amonghors, screlera-non and power combined with light nearly new saddle position case of the olding and many other positive essentials for maximum combine and safety 65 miles per gallon and Con-tent per mile operating cost. Harbest used-value appropriate over built. Thousands of terray scores de v-cred six and seven years upo are in the roday.

Price with complete observing equip-ment \$281.00 F.O. B. Springfield,

Indian Motocycle Co.\

Dept. H-11. Springfield, Mass.

DEALERSI A few good recritories open. Our proviousison is a minute for ambetious men. Wrote new

4	Indian Motocycle Co., Dept. Hall Springfield, Mass Springfield, Mass Serid me your fluxmited Candog describ- ing the Prince and the Scout. Check this if you are interested in our incorr-making proposition to deslets.				
Į	Name	•			
-	Address Caty		\$1100 m		



The Mudral Notes "Bess, "Medium Law Mid-dle" and High the forth in the other waves to objec-table people to homes for and bear



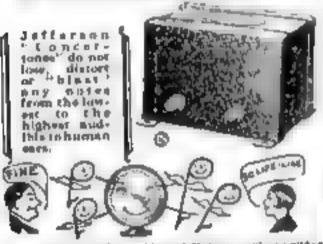
But also! This harpe has a set equipped with common implifying tradeslogment which falled on facts made the course of lasts made the equipped of the course of the equipment of gune). The Sub-regustration ries it be disturted or weakened



Finner-jurnity unity "Maritum Law" on t. Sh. let Nicos pass through with case a d he program doe not accord as a would we n. Base" and 11 h. Notes also present in tall volume.



Conday however to the bone thing a pair of Jefferson Convertable in the set the entracte a Dame water bons to off at the States Marce. The pass through without difficulty and are sent to applying.



As a result all the Musical Motor -eventy amplified —arms in the 14 proper missed as they left the broad-the link a solid terminal with the mare matter to be and the line reproduction of post-

Sexual and long of the sexual new large-size Jeffersons Only \$6 each at the stores Install a see and make your set A 1 27 made n of type

EFFERSON oncertone

(AL-2 BEALE D) MING PRODUCT TRANSPORMERS

Idea (for one with the new Power Tubers)

SEND FOR LATTET LITERATURE

Other John out that are of Bodh. Proceed meking

High A I maderimen by \$1.70 to 10 to 10

Darie 37.50 faile P. Er a to deuters gapestic firsts

fermin Tallen harper a b may sucke on \$1.80

No. 285 percents Tuber have with approximated on

1.10 No. 28 heris and Euror beek. So at



KEEP TUBES LIKE NEW-CHARGE THEM MONTHLY and ALLAT ONCE

Thies reachally wrater will her as on a control of the parties of the process of the parties of the parties of the parties of the effective for a function of the effective for the parties and the effective for the parties of the effective for the effective f

Minhouse remain is required to the probability of the set of the probability of the set of the set

Jefferson Electric Mfg. Co. Largest manufacturers of peal transformers

BOR SO, GREEN ST

How to Make a Miter Box

Invaluable for Cutting Moldings Accurately

By EMANUEL E. BROWN V. Wale of any furnier



Every woodworker needs An Accurate mitter box of



Plane and face mark are aute and edge of I goth for Unicher buttlim meet) then gage the width with dur care

(At right) Square edgen 4 with extreme accuracy

4 Gage 1 . y 'a

p +4 +56

be thus eat nothing on the

s page As

a a a a species

7 4 7 4 4 s a garage 5

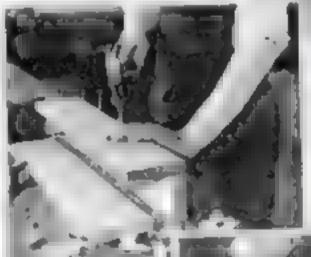
File a serve

5 4 51 7 5 5 eq }

3.4 . . 7 7 N THE 5

1 1

3 The , a thick a tep ecca preferably of hardwood may be of I together in the war for pluning to one ma-



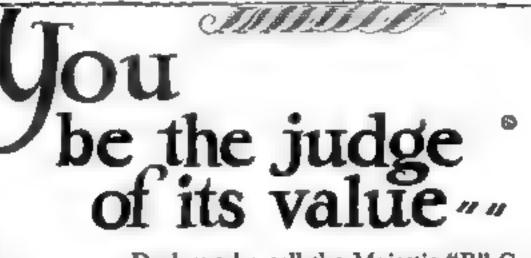


5 Knofe work 45 1 cs with of R Mr. Buch placed no the time an a rest tops rat 9 The side of the state of house for to a provide this years on a or saire elge to the state of th



7 Saw both edges at once with the east and sto be used with he lair. An ad-natsquare out at me end a an aid in out ting squaresy stock of small ilmensions





Dealers who sell the Majestic "B" Current Supply are confident that it improves reception. So confident, they make you this unusual offer: Buy a Majestic today. Attach it to your set and use it for one week right in your own bome. If, at the end of this time, you are not fully convinced that it gives you better radio performance -more dependable power at less cost-your money will be refunded!

Economical to Operate

You couldn't want a better proposition than this. The Majestic"B" Current supply. because of its unvarying constant voltage, gives you improved tone, greater volume-all at the low cost of about one-tenth cent an hour. So you can appreciate that here is a practical radio investment.

Your original purchase price will be returned through operating economy alone.

Majestic'B'Current Supply

delivers pure direct current-from your light socket

Give that set of yours the power it needs—power for any variation in tone. Then you'll have a new appreciation of radio. You will have one delightful program after another-summer evenings-winter evenings —ALL the time!

That's when your set is equipped with Majestic "B" Current Supply. Your set seems Alice with marvelous energy. You sense a new joy in radio,

You at last forget its mechanics, for a simple switch releases all the power you need for any program. Power-cleanconstant—abundant! Power that instantly responds to high soprano, and as easily brings you the full resonance of an orchestration! Easily attached to your light socket saving you constant bother and attention.



SEE YOUR DEALER



Grigsby-Grunow-Hinds Co. Chicago, Illinois 4578 Armitage Avenue

No Filament to Burn Out All the Majestic "B" Current Supply units are manufactured complete in our factory and are equipped with the famous Raythaon Tube. (Endorsed by Burnerous radio engineers and editors) which Is a non-filament tube with full wave rectification, no nelds or back surge. Tests of the Majestic "B" on the oscillograph demonstrate that all

Majestic Standard-B Especially adapted for sets having not more than seven. 201-A tubes, or six 201-A plus one 135-150 volt power tube. Popularly priced for the average set. Improves tone -betters reception. Price \$32.50 West of Rocky Mis. . . \$35,00

A-C hum is eliminated.

Majestic Super-B Capacity 1 to 12 tubes, including the use of 135-150 volt power tubes. Complete with switch to control current from light socket. Price \$35.00

Majestic Master-B Rating 60 mile at 150 volus. Particularly adapted for Radiola 25, 28 and 30 and Super heterodynes. Will operate all power tubes, also the new super-power tube UX-171 (180 volts). Unequalled for sets having a very heavy current draw, Price \$42.50

West of Rocky Mrs. . . \$45.00



-at less expense for coal-and with less work tending the furnace.



Cold rooms - draughts - and wasted fuel are practically unknown in the homes where the Crown Fuel Saver has been attached to the feed door of the heating plants. This marvelous device is a convenience that means better health, more comfort, more happiness for the members of the family who stay at home most of the long winter days.

Thousands of homes are more livable because of the Crown.

During the last 11 years, thousands of foresighted men and women have taken adpennively by the CROWN FUEL SAVER They know the Crown namers only-warpith in every room south lown france dandgery by leasening the number of brings and the genount of ashes some away with smoke and dangerous coal guies and above an mayes enough coal to pay for itself many times over the fact, we guarantee the Crown to make at least a 20° con saving or we will refund its purchase price to mantly and without argument

The Crown works automatically semplifies no atten-From other in the property of margines will first the local on the contract of margines and present the property of the contract of the contra

INVESTIGATE then invest in a CROWN.

As a principle momentum tragger to the term of the morth. while area togacous to be what a tog out if the subtraction has been dealy as if decorate consists and patter heat. Write today for all levals are special low price of Grown with money-back guarantee.

CROWN FUEL SAVER CO. 111 N. 10th St. Richmond, Ind.

Distributors Wanted a real apportunity in the buttle heaving and from the protest of he is and he is not be the in the heaving and from the control of the in the heaving and the interest of the intere

What Causes Sluggish Motors?

By RAY F. KURS

Personal, Automotion Frader School, Cincinnate, Q.

"FOR SEVERAL weeks my engine has been awfully sluggish," remarked one of my neighbors the other day. "It has no power or pick-up. It just drags along. Sometimes I get a great lot of white smoke. The other day a white cloud followed me like a ghost all the way down town. I sure thought I would get a ticket. There are times when I can hardly go at all, and then again, the car seems to do pretty well. I don't know just when it started it seemed to come on gradually, but it's a great numance."

Expressions such as these are common enough. The garage men recognize the symptoms in most cases as being due to trouble with the float of the vacuous tank. This is especially likely to be the case if the car is one which has been in use for a considerable length of time.

Gasoline is very penetrating. Most limple workers know that when a bolt, not lunge or other sun lar part in stuck, the liest rensedy is an application of kerosene. Apply plenty of kerosene and give it time and it will penetrate to the sent of trouble and begin to homen the strick or corroded parts. If it is pus-

sable for kerneene to penetrate along the threads of a badly stuck stud or nut, it is not to be wondered at, if, after two or three years of service. the metallic floats of the vacuum systems are likely to have guthered enough gasoline to lose their bonyancy, especially as gasaline and kerosene are such close blood brothers.

PENETRATING slowly to the interior of the vacuum-tank float, the gasotree granteally desplaces the ner with a indd the time comes when the float is est about on a balance and it is mere claime whether it works properly.

The action of the float and the air valves is pretty well up arstood by most car owners. One line of courser fat i.g. runs from the top of the such im tank to the main lank. Another line turn to the manifold or carbitretor, just above the throttle valve. As the engine operates. are as drawn from the chambers of the vac tage tank and gas reshes in from the many supply tank. When the fleat is raised on the incoming gas at shorts off the suction line and at the same time opens an air vent so that the gas in the vacuum tank may feed out to the carhuretor. After some gas is used, the float falls, then the suction takes place again the float rises, and the valve action is repeated. This goes on automatically When the float is weighed with gaspline on the inside until it barely floats it becomes sluggish in moving the suction line and air vent valves. If it does not lift as it should, it will not plose the suction line in time to prevent raw gasoline being drawn into the intake manifold of the engine and then passing on into the combustion chambers, there to be partually borned. Strange as it may seem, the action may be just on the verge of

can no longer hosp along. Before mentioning the remedy for this trouble, it might be well to point out the dangers. If the thing is chrome and yet not so aersous as to prevent fair satisfartion with the car, the gasoline may be drawn into the engine in such quantities

serious failure for days or weeks. Then

some day it grows so bad that the driver

as to find its way past the piston range and pustons, and dilute the oil as the erankease. Occasionally a driver with this trouble will dom that the old her ir not using any oil any more

" folled her up with oil no weeks ago and now I have more oil than I started with, was the way one chop-

put it. Everyone is educated to the damages that may come from bud cases of crankcase dilution.

In seeking to correct vacuum-tank float trouble the first thing to do is to doconnect the tubes leading to the vacuumtank head and spring them aside a bit The head then may be freed by removing the eight screws used to fasten the head and the inner tank to the rim of the outer tank. Next break the gasket seal gently and lift the head away.

With the head come the valve mechanism and the float. Hold the springs and other parts so they will not ratile and slinke the float close to the ear. If it is loaded with gas, the Equid will be heard sloshing around.

A RIVET of purer the valve mechanism A hords the upper end of the float stem to the lever arm. Remove this and separate the float from the otler parts. Heat a pon of water tise runagh to allow the float to be unmersed outs it comes to a hoil. Hold the float under the heated water and notice the point or points at which bubbles appear. Rolate the float so as to give the air ail opportumity to indicate the leaks. Mark these and then propeture the float at points on its top and bottom. Drain the gaso-(Continued on page 80) line from the

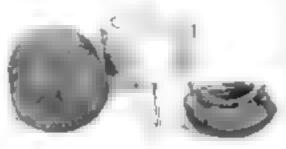


Fig. 1. A hopelessly deterlorated vorcumtank float left a new float centur and a cork carbureter fleet in ght. That collapsed



Here's the most economical Eveready "B" battery ever built for radio

IN THE production of Heavy-Duty radio "B" batteries Eveready has established a new standard of "B" battery life and economy

Eveready Heavy-Duty 45-volt " B" Batteries will outlast any Light-Duty 45-valt "B" two to one regardless of the number and kind of tubes used! Moreover, though lasting twice as long, they cost only one-third more!

To cap the climax of "B" battery economy, in Eveready Layerbilt No. 486, Eveready has perfected a Heavy-Duty "B" battery of exceptional endurance and dependability.

You can make no mistake in buying Eveready Layerbilt No. 486 for any set using normal voltages (45 to 135 volts)

You will be buying the utmost in dependability of "B" power-lower "B" power first cost-greater "B" power



operating economy-D. C. (direct current) in its purest form, which insures pure tone quality

With colder evenings at hand, radio reception is vastly improving. Equip your set now with Eveready Layerbilt No. 486, the greatest Eveready "B" battery ever built for radio.

Manufactured and guaranteed by NATIONAL CARBON CO., INC. New York San Francisco

Canadian National Carbon Co., Limited Tornata, Untario

Totaley aight means Eveready Hour-9, P. M., Eastern Standard Time through the following 9881 robs

nr.-Philade, phia wwo fietenti

what fee fait will-Bafala went Chiefe will Bushes with Peterband with Bushest with Bushes went for noise went of incomplete with Bushes with Busheston with Busheston wwo Detroit papedt, Louis

Make big money from repair work



Practically every household spends at least \$10 00 to \$50 00 each year and many spend several times that much on simple

repairs that can be made quickly, easily and well with

Smooth-On No. 1

By keeping a can of Smooth-On handy, you can save this money in your own home and by doing similar repair work for others, you can make money

No skill is required to make repairs, and the amount of Smooth-On used on any one job seldom costs more than a few cents

Typical repairs that can be made perfectly with Smooth ton -

Stopping leaks in steam, water, gas, oil or stove pipes, mending cracks, breaks or leaks in furnaces and boilers, radiators. tanks, sinks, pots and pails, making loose handles



Look at suffator Joint Smooth-On

tight on umbrellas, knives, hammers, brushes, drawers, etc., tightening loose screws, hooks, locks, door knobs, etc.

On the Automobile Making bursted water jackets and pumps good as new, stopping leaks in radiator, hose connections. gus funk and gas, ou and exhaust lines, making a femisipproof joint between exhaust paper and tomical him it, tightening more head

g 5 t posts, leseping grease cups, bub caps, and nuts from loosening and falling off, etc.

To get perfect re-sults, write to us for and an the Smooth-On Repair book. Free if you return the coupon.

Get Smooth-On No. I in 7 2 1 1b. or 5 lb. fins al any hardware store or if necessary direct from mr.



SMOOTH-ON)

SHOWING

Smooth-On Mfg. Co.

JERSEY CITY, N. J.

SMOOTH ON MEG. CO Dept. 58. 574 Communipan Are., Jersey City, N. J. Pirear upted the free Sprooth-On Repair Sook

Name. Address

Return this coupon for FREE copy of Booklet

How I Transformed My Cellar into A Model Basement

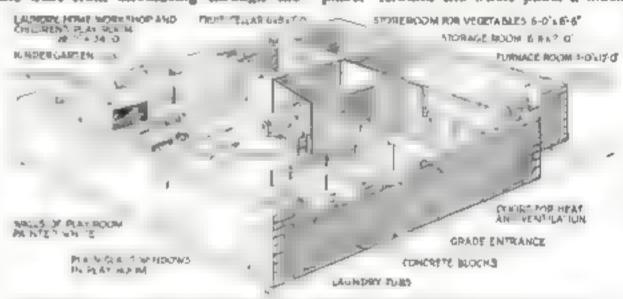
By FRANK I. SOLAR

IN DESIGNING the basement for a model house built in Detroit, I endeavored to make the most use of space that is so often wasted in small houses.

To allow more light to enter the basement, the special window glass was re-placed with plan glass. The next step was to partition off the furnace room, storage room and coal bin. The hin was lined with one layer of builder's paper and another of heavy felt paper to prevent the dust from meculating through the aluminum (powder mixed with varnish)

Two 3-ft, batten doors were made for the openings leading from the main cellar. into the furnace room, These allow plenty of heat to enter the room.

Against the storeroom partition, I placed my workbench, using the wall for a tool panel. The tools were traced on the wall and the outlines filled in with black paint. This little trick makes certain the return of each tool to its proper place. Around the whole panel a black



After partitioning off the furnece room, coal but and score room. Mr. Bolet converted the remainder of the relies into a combination workshop, playroom and usuadry. Note the workbench and tool penel

house. A curtain was made from a strip of old carpet and attached above the coal ben door made so that it could be dropped when fuel was being delivered.

*By taking these precautions against coal dust I was able to burn soft coal with as much saturaction as the more expensaye hard coal or coke.

Of the space remaining, a portion was already taken up by a vegetable storeroom and a fruit cellar, both inclosed with concrete blocks. The rest formed one large, well-lighted room.

I painted the cement blocks of this large room with a special hot water havement paint to within one foot of the floor The last foot and the floor itself were given two coals of gray concrete paint. All the wooden partitions were painted

white and, while I was at it. I painted the farmace black ared administration and touched up valve wheels and other small parts with red. The window frames were painted red and all steel beams and posts black. The pape coverings were left white, but water pipes and other uncovered pipes were painted

frame was painted, as shown above.

Shelves were hung on the wall for children's toys. A kindergarten table was pointed in bright tinta and the top divided into 1 m. squares. Each of the small chairs was decorated differently as children like variety. When selecting colors for decorating children's furniture. I use tents of the brighter colors, that is, I mux the colors with a liberal amount of white

A sand hox was mounted on casters so that it could be pushed out of the way on wash day. A blackboard was fastened to the wall and swings were arranged. A kiddie car, a teeter-totter and a bicycle moon found their way into the piny corner.

is the basement has a grade entrance, our problem of entertaining neighbor

hood obildren is solved. Chalk that, paper cuttings and the usual litter of the players are kept entactly of of the upstairs rooms.

An far as possible, everything in the way of clothes basket table leaves, and washing equipment s out of agat, all are pulnway in their special emphograda and closets.

Ingenious Ways of Utilizing a Cellar

YOUR cellar everyone's cellar ti na individual problem. Even if you cannot make use of it in fast the any described by Mr. Solar you will be very apt to find a suggestion to suit your own needs in another article wheduled for early publication. This will contain the best loats among a large number submitted by readers. of Popular Science Montrely.



BIG PROFITS TO ACENTS AND DEALERS

Our Agents and Dealers make big money selling Metrodyne Sets, You can work all or part time. Demonstrate the superiorsey of Metrodynes right in your home. Metrodyne Radios bave no competition. Lowest wholesale prices. Demonstrating set on 30 days' free trial. Gressest money-making opportunity. Send coupon below—or a letter-for our agent's proposition.

Metrodyne Super-Seven Radio

A single dial control, 7 tube, tuned radio frequency set. Approved by America's leading radio engineers. Designed and built by radio experts. Only the highest qualky low loss parts are used. Magnificent, two-tone walcut cabinet. Artistically gilded geouine Bakelite panel, nickeled plano hinge and cover support, All exposed metal parts are beautafully finished in 24-k gold.

An easy set to operate. Only one small knot times in all stations. The dial is electricasly lighted so that you can log stations in the dark. The volume control regulates the reception from a faint who per to thunderous volume, 1,000 to 3,000 miles on loud speaker! The Metrodyne Super-Seven is a beautiful and efficient receiver, and we are so sure that you will be delighted with \$1, that we make this liberal no days? free trial offer. You to be the judge,

Bays' FREE Trial Metrodyne Super-Six another tot push in a the Here a the new 192 prode Metro-RETAIL PRICE lyne (c. Perker not get by the term Completely Assembled proved by make a more than a form and a short we will be a set of the a form of the set CLEAN TO SERVICE fiscaulty on same and regulage every time. No rue-sing Mr. Howard, of Chicago, said "While five Chicago broadqueting stations are on the air I land in prostant out of home stations including New new and San Prancisco, on the head speaker born, very look and clear as hough they were all in Chicago."

Mail COUPON Below!

Let us send you proof of Metrodyne quality

G. A. Walter. Mariposa, Calif., writer. "Received my Meten-dine No. e I am no C. R. I by the fact have one data with are going to be the removement I had no modific. Into my in our orpe to right to make's august, on you will ploute send in the a part to the

Buy Block, has Francisco, CaRC, writes "Very after the based from New York to the lawnian laboral apticity from at a dat in the based of the list in more known and participated the list of the Mor at ma Panele Don Sei to much waster to operate han any radio art

We will send you handreds of similar letters from owners who account the lifet adyne as the greatest radio set in the world. A postal letter or the coupum brings complete information (est mornels wholesate prices, and our liberal **ye days' tree triel effer.**

METRO ELECTRIC COMPANY 2343-72 M. California Ava., Dept. 160 Chicago, Elimeia

Send me foll particulars about Metrodyne 6 tube and 7 tube sets and your 30 days' free trial office

Address

It was are interested in AGENT'S prop. | asition, place on "X" in the square -

DI. HCT

We are one of the pioneers of radio. The success of Metrolyne sets is due to our liberal 30 days' free trial offer,

which gives you the opportunity of trying before buying.

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 4.

MAIL THIS

COUPON

or send a justal or tetter that pay proposition before buy ng a radio Deal Girect with manufacturer—

Save Money.



Try This Test Yourself

Put auger bit in the chuck of "Yankee" Brace No. 2100. Bure deep into tough wood. Then pull upward with all your atrought. Bit was not come out of chuck.

For this new "Yankee" filt brace Chuck is the most efficient ever made. Ball bearing, quick centering, and accurate.

You can slip into it any shape bit (round, square, any taper) and the bit is there to stay until you wish to release it.

This wonderful "Yankee" Brace is made especially for the man who appreciates a superior tool. For the man who wants accuracy and efficiency. For the man who knows that there is real economy in using the forest tool of its kind because it saves time and labor.

And this new "Yankee" has the famous "Yankee" Ratchet. Schooth as stem wind of a watch, yet unbreakable. Dust-proof and moisture-proof. The handles are hard rubber and indestruction.

"Yankee" nickeled finish—the most durable known

Some Other "Yankee" Tools

Plain Screw bracers Automate Feed Resolide to Rate not or each feed at the Automatic Publisher is Resolution and another a Visit Removalide Rase

Dealers Everywhere Sell "Yankee" Tools



New "Yankee" Tool Book

The agent and little book as an illustration of a last and all the agent and all the agent and agent and agent and agent agent

Anny Bros. Mrc. Co., Philadelphia, U.S. V.



17 [51]

Aloft on Our Clipper Ship

Continued from page 10

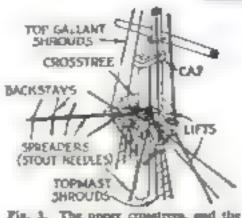


Fig. 3. The upper crustrees, and the method of joining masts; the cap. the spreaders, buckstays, shrouds, and uffs

shrouds. Two vertical bales are hared near the end and at the under sale of each a small glass head is fastened. These are for the chains that run down to the stem (Fig. 2).

The howsprit end is cut square. The jib boom has a hole bured for each of the four outer (head) stays to pass through.

The lowermants each have a fore and aft hole to take the trusses of the yards and an athwart hole under this for the futtock shrouds (detailed on Bluepunt No 55). The fore and main have a nail driven in on the fore side, 56 in, from the deck. The maintaint, 5 in, below its head (upper end), has a wire band with a loop pointing aft.

The lower ends of the masts should extend right to the hottom of the hull, if it is bollow, and have a besiless and driven in to steady them. The upper ends should be cut to a square tenon for the depths of the caps.

The topmasts are cut square at each end and have a fore-and-aft hole for the halvards 136 in. from the head, and an athwart hole for the futtock shrowle below these.

The topgallant (upper) masts are square at the heel, and have holes for each of the three halyards to the yards.

The main-lower-yard in the largest, the other yards decrease as they progress forward and aft, and then up until the min-zen skysnil is reached, it is a bare 14 in, at the mid-lie. The yards are round and taper at the ends to about half their center thickness. The taper does not start until about halfway out.

The lower yards are supported by trusses of copper wice wound tightly around the center of the yard, then twisted together to form an arm much the shape of a boat's rowlock, the stem of which goes through the mast and is clocked behind.

The other yards have holes through them on each side of their mast, through which a copper wise is passed and clinched on the fore side, forming a paired which can slide up and down the mast. In the center of each yard is a vertical hole for the halyard, and near the ends of all is a vertical hole for the lifts and braces.

The hole for the muzenmast goes right through the after deckhouse, and 14 in, behind this is another hole 34 in, in diameter to take the trysail must, the upper end of which goes under the topand is held there with a small hail.

THE spanker gaff and boom should be the three th

A top, cap, cromtrees, and another cap will be wanted for each mast, these are shown in Figs. 3 and 4. These parts appear full size on Bluepunt No. 33, The numberal from which these can be made the cament is celluloid about \$6 to. thick. Such a piece can usually be found at a notion counter. A cap also will be needed on the bowsprit.

Channels are necessary to keep the rigging from the ship's aids. They are strips of wood 2% in, long at the fore and main, and 1% in, at the numer. The lower ones will be a full 1/4 in, thick, and the upper ones, 1/4 by 5/4 in, wale. They are all glood close under their respective moldings, with the forward ends in line with the masts.

For the lower rigging (the shrouds), get,

for preference, aome No. 18 laich fishing cord about in the att diameter and stain it black mouns Set up one of the lowermusta and topmasts with the top and cap. On the starboard (right) sale in the puttock with the mast. hore a hole in the hull 🔏 in. below the lower channel. men the end of the cord in this with a cound tooth pack and a touch of glue.

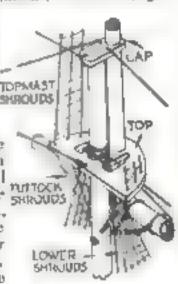
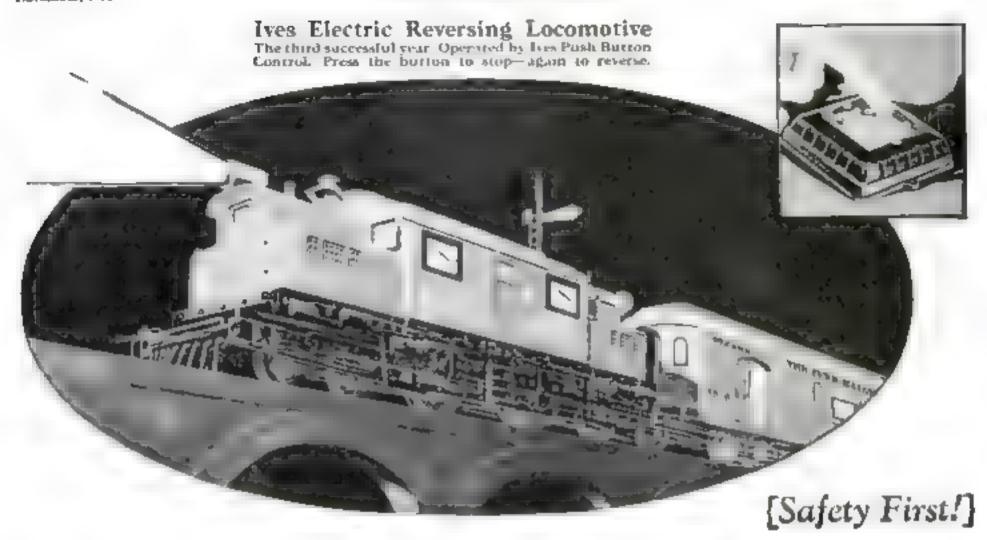


Fig. 4. Lower mosthead, shoulds, yardsom

Take the other end of the cord up through the half circle in the top, between the masts, around behind and down through the top again, to another hide in the same side of the hull, in line with the first. Where the cords touch the channels, file or cut a slot the depth of the cord to take them. Pull them reasonably tight and fasten with another too thines. No the same on the other side until you have three pairs on either side at the I re and main and two pairs at the invite. With this cotton frap (bind) each pair together under the top.

Next come the stays. Fasten one end of a minuter cord to one of the pair of eyes at the forward end of the deck by knotting or seizing (building); pass the other end through the top around behind the lower foremast, carry the cord down to the other eye in the deck, pull tight and finish off.

(Continued on page 50,



Just like sitting at the throttle of the Twentieth Century Limited!

Event day or 3 to P.M. the famous pur of Grand Central Station, New York, on its fait run to Chicago. When it hears a crusing hanjo signals glow to warning red. Auromatic temaphoret ga de it at every stage of its journey "Danger shead?' a signal warns suddenly. A touch of his hand, and the engineer stops the train. Another touch, and the train

You can do all these things with your wonderful Iver Electric Train. The Iven express speeds around the track. Automarke Signal 334 flasher out the warning at the highway crowings, keeping the prack clear Native Field Named 131 flasher to the engineer danger or clear track, at the case may be

When Signal is flavier the red press the horron and the train stops. Press t again, and it backs in to the point of pafery. Now the light Hashes green. Press the burt in twice, and process in that parties I now can you beat it for

real good fun and reabsm

Every up-to-date feature

INES Trains have every device ever in year from king o marine rame ast his the throads so the famous ranscenwire. Ming of these up-to-date features. Anday.

are Ives inventions. Many of them are found exclusively in Ives Trains (the automatic Rango ugnal for example) Unit e harai herem ween improvement

lves locomotives have all kitch of power for pulling long trains at express spend. An more is, even the smallest, are built with extreme care. Sluming brass name and number prairy man the cars and decomonives though of beauty lark Transfermers to b ch are power plants for any electric trains are the most mexpenaive as well as the most efficients in canling.

You have a favoristing selection from the almost embicus variety of passenger and freight cars, electric ta get signals. and remaphore stanger, tiponals, bringers, startion, etc. Prices range from the Acida mechanical read to the big complete &.

Lex department electrical, bardware and specting goods stores self ives I rains

Biggest, most interesting Train Book for boys ever issued—FREE

Inte 1,26 Book of Ives Trains is the largest mest color-tial and fast nating back of miniative radiouss ever pin lithed It has as pains. mittated in the ed on the same and tolk you we thing you want to know about electric theoria firers. The only difference is more and mechanical trains. Mail the coupon

Ivea Automatic Two-Light Target Signal 331 (For any algo track

Is flashes red—is flashes green The protting agend over seen





For any size much Three automatic leatures in one fres is the only this wooderful netomatic ban to eignal !



THE IVES MANUFACTURING CORPORATION

Enablished 1868

Holland Avenue, Dept. E4, Bridgeport, Conn.



THEOL	S MANU	FACTUR	ING CORP	DRATION
Depr Et	. Hulkand	Ателие,	Dridgepon	t. Cunn

Plane and one year FREE, 1926 Bank of Iven Trains containing the

4 ---



However storms may interfere with travel, telephone operators are at their posts

An Unfailing Service

AMERICANS rely upon quick communtention and prove it by using the telephone seventy million times every twenty-four hours. In each case some one person of a hundred milhon has been called for by some other person and connected with him by means of telephone wires.

So commonly used in the telephone that it has come to be taken for granted. Like the air they breathe, people do not think of it except when in rare instances they feel the lack of it.

Imagine the seventeen milion American telephones dumb, and the wires dead. Many of the every-day activities would be paralyzed. Mails,

telegraphs and every means of communication and transportation would be overburdened. The streets and elevators would be crowded with messengers. Newspaper men, doctors, policemen, firemen and business men would find themselves facing conditions more difficult than those fifty years ago, before the telephone had been invented.

To prevent such a catastrophe is the daily work of three hundred thousand telephone men and women. To maintain an uninterrupted and dependable telephone service is the purpose of the Bell System and to that purpose all its energy and resources are devoted.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY AND ASSOCIATED COMPANIES



IN ITS SENI-CENTENNIAL YEAR THE BELL SYSIEM LOOKS FOR-WARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

Read interesting article on Page 4, "How \$100 a Month, Invested Properly, Can Make You Independent."

You'll Build It Better with a Boice No matter what you want is a bouch machine, you'll got it with granter spord, amountary and economy in





Tis Tome Workshop

Aloft on Our Clipper Ship

(Continued from page 88)

The mam stay is carried to staples just forward of the foremast. The maxen stay comes to the nail in the mainmast mstead of to the deck. These are double stays, the two parts of which are frapped (bound) together under the tops.

Now ship the topsail yards onto the topmasts, put the crosstress in pontion, and set up the topmast shrouds. They can all be in one piece of cord, thinner

than for the lower shrouds.

Starting at the "top," reeve the end through one of the holes in the rim. carry the cord through the creatrees, between the masts, down through a hole on the other side, through the lowernsast, and so, round and round, until you have three on either side, Then the two ends can be knotted together under the top.

THE topmasts have a pair of backstays on each aids, set up the same

as the lower shrouds.

The bowsprit and jib boom had better he set up next. Ship the bowsprit in its hole in the bow. Set up tightly the two bobstays (claims) from staplet in the stem to the heads under the sprit. Then fasten the shrouds (chains, from the wire eyes at the sides of the sprit to the staples under the exthesels. Put on the cap and through it reeve the ph boom with the inner end, cut to a bevel, resting against the stem. Three-eighths meh above the stem lash the two together.

Make a martingule I in long and 14 in in diameter. Rather less than halfthrough it, cut a gruove at the end, and at the top drive in a beatless pin, the other end of which goes through a hole under the cap into the bowsprit.

Now the a chain uniter the boom near the end, bring it down to the martingale. and up to the boom again, halfway between the first end of the chain and the cup; this should be tight when the martingule extends down at right angles to the boom. Fasten the bight (loop) of another chain to the same place on the martingale and bring the ends back to the ends of the cathends.

LL this headgear can be of rope, but A looks much better of chain. Lengths of chain in different thicknesses usually can be found at notion counters in the form of cheap lavalieres. A better quality is sold by opticions for eyeglasses. For the bolistays there should be ten or twelve links to the mich, and for the others considerably more. All chains should be painted black.

Hitch the center of a light cord to the in boom where the topmast stay comes through and fasten the ends to the cathead. Do the same from the boom end.

These are the boom guts.

Seize the bight of a cord round the boom at the bobstay, take the other end up through the fore croastrees, behind the must, down again, through the first hole in the boom. Continued on page 92).

Are <u>You</u> Really Well Informed?

Test Yourself with this Famous Questionnaire!

CVERYBODY is talking about the fumous "Popular Science Questionnaire." In the panel is the list of questions of which the Questionnaire is composed. How many of them can you answer?

These questions were prepared, after a great deal of thought, by a group of eminent assentists. Their test has become famous throughout the country as the "Popular Science Questionnaire."

Like an Old-fashioned Examination

May we ask you to make this test carefully, reading the questions slowly and giving thought to each one? When you cannot answer one satisfactorily to yourself, put a zero (0) beside it.

On the other hand, give yourself credit of four (4) for each satisfactory answer. Then when you are through, see how near you have come to making a mark of 100.

This is like an old-fashioned examination, but you will find it fascinating. The questions all have to do with the wonders of the world we live in. All can be given quick and straightforward answers by any person of education.

All of the questions in the famous "Popular Science Questionnaire" and many hundreds of others, have now been answered, for the first time, in one book—The Pocket Guide to Science.

Tate his torre we had been conducted the circumstant and the circu

All that you probably ever will want to know about science is told in this one 284-page book that will fit in your pocket or grace a library table. Curiosity-satisfying facts about the world we live mare made instantly available to you in simple question-and-answer form in The Pocket Guide to Science.

You are assured of the accuracy of the answers in The Pocker

GUIDE TO SCIENCE because it has been edited by Dr. E. E. Free, who has remarkable genius for condensing the known facts about scientific questions into easily remembered paragraphs.

SPECIAL OFFER

THE POCKET GUIDE TO SCIENCE is not for sale. It is offered to you without one penny extra cost, with a 14 months' subscription to Popular Science Monthly.

POPULAR SCIENCE MONTHLY "CARTIES ON" from where THE POCKET GUIDE TO SCIENCE leaves off. THE POCKET GUIDE gives you all that the scientists have discovered up to right now—Popular Science Monthly will give you all the important, interesting and new discoveries of science for the next 14 months.

It takes over 300 articles and pictures every month to tell the readers of Popular Science Monthly all that has happened in the scientific, radio, mechanical and automotive fields.

Your Name in Gold

THE POCKET GUIDE TO SCHNOE IS bound in beautiful desible fabrikold. We will stamp your name in 22-cares gold on the cover of The Pocket Guide as no extra cost to you if you use the coupon below sumediately.

We extend to you the Special Offer of a 14 months' subscription to Popular Science Morther (regular price by the month would be \$3.50) with The Pocker Gothe to Science—all for \$2.95, plus the few cents' postage. If you are already a subscriber to Popular Science we will extend your subscription 14 months if you accept this offer.

Send No Money

Send no money had the coupon. If within 10 days after you receive the book and magazine you decide that you are not satisfied in every particular, you may return them, and your entire payment will be refunded promptly and without question. Could any offer be farren?

POPULAR SCIENCE MONTHLY 250 Found Avenue, New York

I seek jid wood with the Targe The latter for my year decreases and a. I contribute the latter to the first of the first on the latter to the latter to the first on the latter to the l

, State. ... w

P 8 31 11-26

Num.

4 Supplement

In using Coupon please PRINT Your Name.

The POPULAR SCIENCE QUESTIONNAIRE

Test Yourself Now

- Who does radium a systeme to their sof heat for thousands of years
- Are the more could like the earth.
- 5. How was the earth formed?
- 4. Why is glass transparent!
- 5. How we we know that the cost this slowly shanking?
- 6 What to an electric current!
- " How was prevolence formed?
- 8. Pro ejectrons really move through wite when in elected outline it flowing through tri-
- What physical changes in your body are produced by feet?
- 13 Host do musiles exert power! What are X rays!
- Can we we atoms with a microacopt

 Why does heat suppord things
- and cord contract them?

 14. Why does the moon appear to
- charge to shape from time to
- H. What is the brain made of
- [6] Who is in complete that the remate of the month in givening house assessed of cotons.
- 1 % has as frost among library on a quart marky visitor to plan and a poper.
- in the second
- the the major favor electricity of the .

 What our de tro will distinguish would them a pettern
- A har maken the none of thurs
- II Why would men altimate a perforate all the street practic were board.
- Does the brolling of water remove the amputation in a.
- 14. How do the living cells of the body get the energy with which to do their work.
- 25. How to the spread of light mea-

TOTAL PERCENTAGE





It doesn't take a battery expert to buy the best battery

Anyone who walks into a radio store and usks for a Prest-O-Lite Storage Battery is making as wise a purchase as any battery expert could make.

The name "Prest-O-Lite" stands for storage hatteries made by a company that for more than twenty years has ngidly maintained the highest standards of manufacturing skill and honest workmanship.

Prest-O-Lite Radio "A" and "B" Batteries have been perfected especully for radio use in the world's largest electro-chemical research laboratories,

They are not only made to give you long years of service, but they can be depended upon to deliver their rated ampere-hour capacities. These two qualities constitute the real measure of battery value, and hours of radio picasure result.

Prest-O-Lite Radio Batteries are attractively priced from \$4.75 up. It is unwise to take a chance on batteries of unknown make. Ask for Prest-O-Lite.

THE PREST-O-LITE CO., INC. INDIANAPOLIS, IND.

New York

San Francuco

In Canada Prost-O'Lited surport of annals, List.



What agreement of a radio stockal business in it is may death of the first the white a harrier of the arms and a side front destroyer of their the place of the arms and the side front that the ordered place and trade the side arms and arm the motors. It is possibly in the arms and head inhitigations.

Designed especially for radio

rest-O-li

STORAGE BATTERIES FOR MOTOR-CARS AND RADIO



"HI-OHM" Volume Control and Filament Switch

Simplifies the operation of the set and climmates the battery switch. As soon as the knob is turned from "off" position.

the filement evitch is closed and remains closed until the "HI-OHM" is turned of

Any dealer can supply

In Canada - Carter Radio Co., Limited, Toronto

54 M40 Resistances





Aloft on Our Clipper Ship

A national from page 50)

down under the wire in the martingale and back to a staple just forward of the cathead, hanking tight and finishing off; put a sessing around the two under the crusstrees,

A semilar stay at the mainmast goes from the nail in the lower foremast round. the crosstrees and down to a hole shaft. the foretop.

There is only a single stay at the misseumast from the musthead to the

SHIP the topmast caps and the topwas done for the topmasts. Put on the topgallant yards, set up the shrouds (Fig. 5), two on either side; fasten them to the masthrad with an overland knot, set up the stays, getting them well tight. The one at the foremast reeves through a hole in the boom and fastens to the hull on the opposite aide to the topmast stay The lead for the other stays can be seen in the plan (Fig 4)

Put on the royal yards, set up the backstays and stays, and do the same with the skyant varis, backstays and stays, These latter should be of a grade thinner. cord, such as staut linen button thread

or bend twurt.

Take some stout needles about 1 14 in. long for the fore- and minimist and drive the points in, to lie on the cross trees under the hights of the rigging (Fig. 3) These face aft at an angle of about 45 deg. from the center line of the model. To these sense the backstays, drawing them aft to even spacing. Paint the needles white.

Rataines (or steps) will be wanted for the lower and top rigging. No. 24 colton thread will do for them. They may be clove-hitched to each shroud or to the outside ones, but this is rather clumiy and tedious for so small a model. In stead, the thread may be threaded on a needle which is passed through the outside shrously and in and out of the others. The ends should not be cut off too closely.

The rigging then is given a coat of thin black sheliae or enamel. When dry the erels are cut off close with a raxor blade. or fine seissors.

THE lifts to hold the yards horsental are of cord. They are passed up through one hole at the yardarm, hitched at the mastheads, and then carried down through the other yardarm, with small knots underneath. Those for the lower vards pass through the boles at the sides of the caps,

The topsoil yard halyards (shown in dotted lines on the foremast only in Fig. 2, but used, of course, on all yards but the lowest one on each most) come up through a hole in the center of the yard, with a knot beneath; pass through a hole near the masthead, and go down to a double block about I in, lower than the top. A single block is made last to a staple at the side of the deck, under the (Controped on page 93) ngguig. Thm



To Home Workshop

Aloft on Our Clipper Ship

(Cant. nam! from page Rd)

bead twist is rove through these blocks and fastened off with a toothysek to a bule in the top of the bulwark. At the foremast. the halyard comes to the starboard side; at the main, to the port; and at the missen to the starboard again.

The other halvards are similar except that two single blocks are sufficient for the topgallant, one for the royal, and none for the akysail. They come down

to alternate sules of the deck.

The blocks are made from boxwood or any non-splitting wood; holly answers the purpose well. Their shape is shown in Bluepeint No. 53. They should all be about as small as you can make them. may 16 in, for the larger blocks and less for the others.

The way to reeve the braces can be seen in Fig. 2. They can be of thin head twist. Do not use cotton thread if you can help it, because it is harry and given and taken with the weather in that

acon it is hanging slack.

THE general idea of the braces is to swing the yards round on their parrel axis. They should be so arranged that if the yards were hoisted to the mastheads, they would lead alightly downward w thout touching one another and with an few bench as possible on their way to the deck, where they are belayed.

The lower yards should, if possible, have claim pennants (see Fig. 2). Note that the missen yards lead forward to the mainmant, the crossack (lower murger, leading to the wire eye on the main lower must and down to the file and. The main braces start from the ends of the

bumpkins.

The inner ends of the spanker gaff hang by a two-single-block molds to the top. The peak halyards start at the end, pass through a double block at the cap, through a single block halfway out on the guff, through the cup block, and to the bandrail. A single line runs from the end, at either side, to the handrail. for the vangs (stendying lines), and another cord supports the outer end of the boom from the same place.

FOR sheets, the boom has a two-single-block tackle on either side, to staples in the deck. It has topping lifts from the end through single blocks hang from the tup. This completes the rigging.

A boat in davits (Fig. 1) will be wanted on other sine abalt the main rigging The dayles, which are stiff twisted wire are set in holes to the balwarks. The boat on one side should be double-ended (a surf boat) and the other should be square-sterned. They are hung with double-block tackles to small staples in the ends. The ends of the tackles are bitched to one davit about halfway lown, brought up under the boat, and hitched to the top of the other day it

The boats should have seats, and if you tike, oars. They should be white

with brown gunwales.

The anchors can (Continued on page 95)



men told 1000

what they most wanted in a shaving cream

Then we made this unique creation to their order—as a courtesy to us, please accept a full 10-day tube to try

GENTLEMEN -

We went great lengths to please you to a shaving cream. Then gained a great market as a result. From the beginning, men by the thousands flocked to its use.

We started by asking 1000 men their supreme desire in a shaving soap. They named four requirements. We met them one by one, then added a tifth they had forgotten

We tried and discarded 130 formulas before we found the right one. It required all our expert knowledge as soapmakers—we're the makers of Palmolive Soap as you know-to meet those requirements

The best of the first of the state of the st

Now men tell us we have a creation superior in 5 important ways to any other known. The coupon below brings you a to-shave tube postpaid. Please use it, let us show you what we have done.

Five advantager

- 1. Multiplies itself in lather 230
- 2 Softens the beard in one minute
- 3. Maintains its creamy fullness for to minutes on the face
- 4. Strong bubbles hold the hairs erect for cutting
- 5. Fine after-effects due to palm and olive oil content

Just send coupon

Your present method may suit you well. But still there may be a better one. This test may mean much to you in comfort Send the coupon before you forget

THE PALMOLIVE COMPANY FOR Corp.



10 SHAVES FREE

and a can of Palmolive After Shaving Talc

anyly owers poor man; and address and mail to Dept. % tife be Paldindrer Company Del Corp Je 17th Iron Street, Change.

Residence of Wiscoms and address The Palmedie Company. We say a Nowakate R to

"I could almost shave with this"



IT's the cutter of chromium steel from the Sargent Auto-Set Bench Plane, Keen, Edge-holding, Easy to sharpen when necessary because of the exclusive Auto-Set feature. This permits cutter to be removed and replaced in a juffy without changing original adjustment.

Sargent Auto-Set is the most convenient all-round plane you can use. Designed primarily for professional use, it has also been enthusiastically welcomed by manual training students and instructors and by folks with home workshops.

Sargent Steel Block Plane should also be on every school and home work-bench for the smaller jobs and for finishing. As in all Sargent Planes, its cutter is of chromium steel, placed at a low angle; it is particularly fitted for end work. See Sargent Planes at almost any good hardware store, and write us for interesting

BARGENT & COMPANY, Manufacturets 50 Water Street, New Haven, Conn.





Over four million patented Charles Sain used by bushing buttery Manufacturers as standard equipment in Charles and Power Lidta. Ask your dealer-if he can't supply, send seventy-five cents to

THE CHASLYN COMPANY 4413 Revenewood Ave.



Aioft on Our Clipper Ship

of uniforms, from page 03)



The Sovereign of the Seas under full sail, from a lithograph published in 1852

be bought ready-cast from brouse or white metal, or cut and haramered from sheet lead. The shank should be about I is in, long. The stock is of wood. stained dark brown, the metal part in black. A chain should be faitened in the hawarpepe with a bent pin, and to a ring, which is hung from the end of the cathead. The crown of the anchor is lashed. to a staple on the forceastle deck,

A short chain should hang from a staple in the rudder and fasten to others under the counter (Fig. 2).

Each must should have a small flat.

glass bend at the top for trucks, these may be gilded.

The house or company flag at the main is three V-daped stripes, blue, red, and white, the white being at the outside,

THE National Energy can be the tottal I one or, more correctly, with only \$1

The base may be a board of any wood about 4g by 41g by 18 m., on which are glued and naded two uprights shaped to the under side of the hull, with alots to take the keel. These may be cut from tempiets IV and X, but will not come so lingh. They can be quite plain or carved or any motif. Make sure that the ship is upright in this and with a level keel.

The name of the ship should be on both sides of the how just aft the entheads, and also on the stern, which also bears the port of registry-New York, in this case, If you are a next letterer, paint these on with white. If not, cut out the name plates given on Blueprint No. 5% as close to the lettering as possible, go over the blue background with black drawing ink, and glue them on.

A final touch-up here and there, with a glance sloft to see that all in taut and shipshape, and your little Sorereign of the Seas is complete a reminder of the glorious days when America's fleets were her prode and joy, when these white-wanged things of specif and beauty carried her trade and her people, and bred a hardy race of advenвирона диет.

VAPTAIN McCANN is now at work on the fourth in the POPULAR SCIENCE MONTHLY series of simplified ship models. If you like to build historic ship models, you have a treat in store.

Sluggish Motors

(Confinues from page 84),

float through one opening, allowing the necessary air to enter the other opening When thoroughly drained, solder the leaks and the punctures carefully, retest the float, and, if satisfactory, reassemble

The deteriorated float shown in Fig. 1 is an extreme instance of float failure. Perhaps winter storage caused it to be attacked by rust. A crack showed and the finger of the workman went right through when he pushed on it a bit. Many floats appear to be perfectly good. yet are half ful, of gasoline

While it is well to know the repair method given shove, it is also good practice to replace the had float with a new one. This, however, is not always possible. The writer carries soldering er, apprient in the examping outfit and more than once has had occasion to repair vacuum tank floats when notes from any garage. However, he has not always

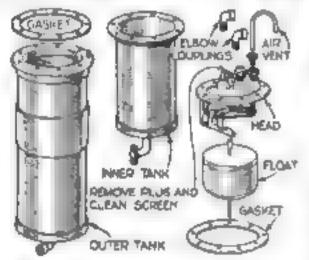


Fig. 2. How the various teak is taken spect for remedying float trouble and for cleaning

heen so fortunate. On one occasion he was stranded about midright in a town some miles from home. A white cloud of smoke had been following the car for unles. The motor was running very erratically. The car was coaxed along for seven miles to get to town, only to search without avail for a new float or even for a sol lerrig oatfit

In aesperation the float was removed The leak-could not be found. Two notes were paneled in with the point of the cotter key extra for and the gasoline drained. The holes purched in were then prigger with short pieces of match sticks and the , b reassembled under the street. light. The float took the car home and contributed to operate for several days until a new float cound be secured.

When the head of the tank is off remave the inner tank (Fig. 9) and clean t, crean the outer tank, inspect the mechanged condition of the float valves. stirings and levers and then reassemble the entire job. Make certain that the vent hole which serves to vent the nuter tank, so that gas may feed from it to the carburetor, is open. There are eight holes for the screws and one hole for the vent in each gasket and in the flanges. The tank head has the vent in it running to the air valve. (Continued on page 96)





Man-power



The laboratories and shops of industry are the sources of many of the enduring attainments of our times. In the General Electric organization is an army of 75,000 persons, cooperating to make electricity do more and better work for you.

Four millions of the best manpower of Europe perished in the Napoleonic conquests. Military conquest is non-creative, while industry is always creative.

In the last ten years one American manufacturer—the General Electric Company—has created machines having a man-power forty times as great as that of all the lives lost in the Napoleonic wars.

GENERAL ELECTRIC



Sluggish Motors

Continued from 1000 85)

which controls the action of the tank. If the vent is not kept free of dirt, or if the workman assembles the head in a new position, as in possible in some instances, the vent will be blocked and no passible can be drawn from the tank.

Carburetor ficals sometimes fail in a manner similar to the vacuum-tank float. If they are of the hoslow metal type they may be repaired and tested in the same manner. Cork floats fail at times, too. The cork carburetor float illustrated in Fig. 1 went entirely to pieces and had to be replaced. Cork floats which are logged with gasoline can be baked and then reshellscked, but it is a task requiring patience in baking out the gas or the float will be ruined.

When a carburetor float is logged the owner usually has an indication of the trouble, more the floor of the garage will show the leak

A Flexible Sandpaper Block

A RELATIVELY

denote on a depaper block may be made quickly as above from a piece of wood 14, by a 3% by 6 m., or any other convenient base, and a piece of thick leather. A series of saw cuts



For mandpagaring flat

are made nearly through the wood and the leather facing is glued to the bottom of the block. C. G. P

How to Construct a Cork

To the Editor. Our fills for the thin expense were exceedingly high for the remain. I be now that har not fort which as a set outlinear consenerch, yie, in each properly insulated. Could I has a investigation of seal a great test to a my space time are if so, have you contable plane? C. H. Baltamara, Md.

ANY HANDY man can build an excellent ice box without special tools, equipment or experience—an see box that will have three melies of cork insulation and thus insure a lower temperature with less ice than the average refrigerator. An article felling how to construct such an ice box was published in our July 1984, issue, copies of which can be obtained for 40 cents each white they last.

A Lighter for the Fireplace

FOR lighting fices in the fireplace on chilly fall days, a so-called Cape Cod Firelighter sometimes is used. This consists of a clay ball seaked in kerosene. A substitute for it may be made by winding narrow strips of sheet asbestos around the end of a long steel rod to form a cylinder about 2 in. in diameter and then wrapping tightly with copper wire. Soak the asbestos in kerosene and use instead of paper and kindlings.—L. B. Robsities.

Let's Pian to Make Our Christmas Presents

DID you ever stop to consider the advantages of making, rather than buying, Christmas presents? You spend less money, you enjoy all the fun of constructing them, and you have things to give that are of greater intrinse and sentimental value.

Why not start now to make Christmas presents? The Home Workshop blue-prints listed below offer you a wide choice of projects—ship models. Nos. 44, 45, 46, 47, 51, 52 and 53), a variety of toys (Nos. 13 and 28), radio sets (Nos. 41, 43, 54 and 55). farniture of all lands, and, perhaps best of all for boys and men a workshop bench. No. 15), and a tool cabinet and various bench fittings (No. 30).

Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from Popular Science Mostrilly for \$5 cents. The Editor will be glad to answer any specific questions relative to tools, material or equipment. Blueprint Service Dept.

Popular Science Monthly 450 Fourth Avenue, New York GENTLEMEN

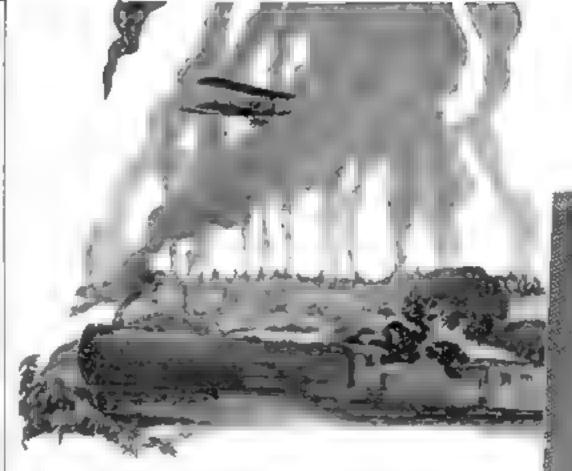
bend me the bluepriat, or bluepriats, I have underlined below, for which I inclose cents

99 1	IND A DIVIONO A A		-	CHO
$A \in$	Total	Pakk	iked	Print
1	Sewing Table	Feb.,	13	25c
2.	Smoking Cubines	Maria	32	75c
5.	End Table	Apr.,	.11	354
5.	Kitchen Cabinet	Miny.	,33	15c
	Shaying Cabinet	June.	31	75c
- 9	Arbor Guic and Seals	July,	21	15c
10.		Aug	21	25c
11	Bench and Tilt Tuble	Sept .	2.1	115c
11	Electric Washer	Oct	'21	254
1.1	Ten Wagon	Nov,	33	154
14.	Christmas Toyo	Devis	2.7	75c
1 5.		Jun	13	15c
Lø.	Inland Madio Cubistet	Feb .	23	134
17	Ceder Chest	Mora	'73	15c
l-III.	Phone Table and Stool	Mars	'23	15c
19		Apr	33	7.57
70.		A\$17.4	7.3	75c
21	Colonial Druk	Apr.	23	15c
27.	Cubinet and Desk	Apr	33	254
23.	Pergola Gerage	May.	23	25c
24.	Careleg Table Canne Bauing Outli	MENE.	2.1	15c
15.	Capter Bruing Outfit	luly	33	75c
76.	Buby a Crib and Pen	Bept.	1.1	25c
27	Kitchen Cabinet Table	Oct.,	23	75c
28.	Pullmen Play Table	Nov.,	23	25c
29.		Dec.	23	35c
30.	Tons Cabinet etc.	Just	24	25c
31	Sewing Cabrneta	Peb.	24	25c
32.		Mary	24	350
13.	Dining Airore	Apr	204	25c
34.	Gurden Trellines	May.	24	15c
13.	Simple Radio Cabinet	Che s	29	23€
36.	Rush Buttum Chair	Nov.,	124	23c
37	Simplified Bookcase	Der.	24	25c
36.	Shereton Table	Jan.	25	25-
39	Salem Chest	Feb.	'25	25€
40.		Mar.,	23	75c
41	One Tube Redio Set	Magn	25	25c
43	Three Stage Amphilier	June.	.52	25c
43.	Four Tube Rece ver	July.	15	25c
44.	Pirate Sh p Mostel Holl	子4年	24	134
45.	Pirgte Borp. Details	Max -	16	25c
46.	Guileon Model Hull	May	26	25c
47	Galleon Model Details	May,	76	35c
44.	Sailing Yach: Model	July	,16	75c
40.	Broom Cabinet	Aug.	36	25c
30	Airplane Model (Flying)	Scpt.,	'76	35c
51.	Clapper Ship Model Hull	Oct.,	'26	15c
	Chipper Model - Details	Ort	26	25c
53.	Ci pper Model Rigging	Oct	26	25c
54	F ve Tube Radio Ser	Oct.,	76	25c
55.	Five Tube Set-Details	Oct ,	716	15c

Name N (Please print tages and address very clearly).

Strong

City and State



NICHOLSON

are the most necessary and versatile of tools

In the thousands of factories manufacturing everything from delicate instruments to steam engines, you will find NICHOLSON Files busily at work.

In the repair and maintenance of these almost countless machines and instruments—there again you will come upon NICHOLSON Files.

In keeping edged tools keen and efficient—once more NICHOLSON Files are depended upon for their quality and stamina.



NICHOLSON FILE CO.

Previdence, R. I., U.S. A.

-a File for Every Purpose



With a Graflex you can "stop" the flying feet or hurtling ball. You can be sure of pictures that are sharp, spirited-and the method is easy. Watch the action in

the hood, trip the shutter at the thrilling instant. You see that focus is right, you

see what the view includes.

Shutter speeds range up to 1/1000 for open scenes and down to 1/5 for shade. PART HEUTTER. And the big lens lets in plenty of light. PART LINE The 81/x41/4 Revolving Back Graflex, Series C, has a Cooke Anastigmat f.2.5, over three A NEW MODEL, times as fast as the fastest lens previously offered. With this new camera, anappy, detailed pictures are obtainable even in dull light. Price \$260.

> Other Graftez cameros as loss as \$58.50 Viest a dealer or write to Rochester

Made by The Folmer Graflex Corporation, Rochester, N. Y. For sale by Eastman Kodak Company, Rochester, N. Y.



who want to be manly in their first long trousers I it sports ask for knicker Bostons

George Frost Company, Makers, Buston

et B UNIT"POWER

Тура М complete with

tube



Delivers the proper voltage at all times without a trace of a ham. Standily countracted to cast as long as the best rach ent

A full water rest for culte is used, no filaperat to burn our Asmable resistances our sell leper or and amplife a stage a situal tap for saver tubes. Flenty of current for any net on by market

Louise Price Righer Quality Problem Government

Sold direct I me the factors to you and thro
our authorized representatives. Wide I did no
plete absentation. Unit shapped prepaid ou
receipt of \$25.00 or C. O. D. for \$25.00 plus

GEORGE ELECTRIC COMPANY

761 Curleton Ave . St. Paul, Minn.

Genry & Dealers waterd

First for attractive strengt proposition.

The Mome Works hop

A Match-Holding Bird for Your Smoking Stand

By F. CLARKE HUGHES

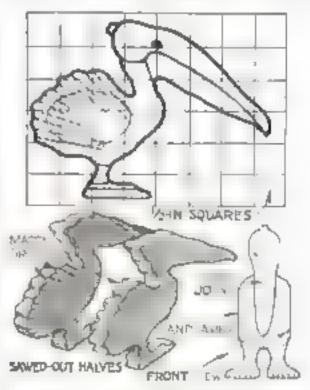


A queer bied in this pelican with hitchen matches in place of tast and wing fasthers

THIS wase and useful pelican—or is it a dodo hind?-- is easy to make and yet forms a most unique and colorly little ernoment for any smoking stand or table

Choose a scrap of some extra soft wood, such as clear white pine, 14 m. in thickness. Make a cardisond pattern for the tirel's body by dividing a 3 by 4 iii. rectangle into 15-m, squares and then enlarging on them the diagram shown below. Trace the pattern or the wood in two places and cut out two identical pieces. Have the grain run parallel with the about of the bird a neck

When the sections have been sowed to they will fit togetoer, mark the untels grooves on adjoining faces and cut them with the parul of a sharp penkinge. Each grouve should be one half as drep as the thickness of an ordinary kitchen match Then, when the parts are glued together so that the grooves committee, the holes are



view, and a diagram on squares for enlarging

all ready for the matches, except those for the two wing-feather matches. Open slots for these may be cut with the penkinge, as the sandpaper will help hold them in place.

Glac a small strip of wood to each foot. to form a winer base. Carve the body and feet, fasten on the eval pieces of sandpaper, and finish with bright enamel or lacquer colors, as indicated in the upper illustration. Finally, glue a piece of felt on the base.

A Shop in 4 by 7 Feet

(Continued from page 81)

ready and warm in winter when I came home rather tired out with teaching.

Strange as it may seem, in this tiny shop were the following things:

Facing one of the windows was a common kitchen table, made into a bench with pumerous tool racks on each side. On the extreme right-hand side of thus table was incunted a small polishing head. and countershaft rigged up with an old sewing machine wheel for a drive, under the table.

On the left-hand side of the table was a homemade soldering stand made of two small flanged pinleys and a tra pre plate. one palley acting as a base. To the upper most a fley was reveted the pic tra for holding bits of purisce static at a support and heat reflector for soldering. On this sample shand with the aid of my fost

AS furnished my light and was piped. G by payelf all about the shop for Bunter barners and a prot light ownch. I used as any pape aighter us often us not

bellows and gast fired blow torch I did many a large job of soth soft and hard somering.

Over the bench there were tool and supply closets and then shelves up to the cering, ad built in without repaying the wals or woodwork. The landlady lived just below us and she was a very good sort, and I was careful pever to make much noise. Most of the woodwork and fittings were cut to length before being brought in the apartment and then screwed together to do away with the noise of nailing. It is notes astomshing how much work one may do without noise, if necessary.

On the side of the shop opposite the door was a small speed lathe which was very completely fitted out with slide rest, chucks, and the like. On another worktable was mounted a fair-sized basel printing press. On this we did considerwhile decorative prosting, making most of our own Christman carea. Over the press were shelves, and more shelves.

There was a st room as the shop for me to at comfortably in one place, and reach anything I wasted (Fig. 1)

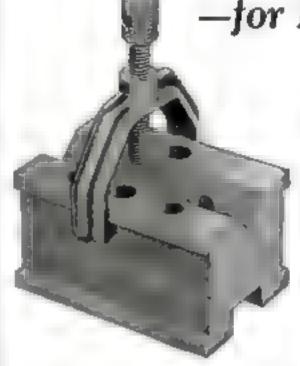
Amnag the am using things in this shop. was a tary M-horsepower gas engine, air cooled. This can with little more noise than a sewing machine when midded but there was a great deal of smoke from the exhaust. Now it happened that we lived in that part of town where it was the fasmon for most of the housewives to set their cooking pots on the window sills to cool, as a windy might and falling pots testified. Mostly these pots sent off clouds of steam when cooling, so I set up my engine, the smoking tendencies of which I well anew, and I took an old cooking pot, knocked a bole in it for the exhaust pape from the muffler, set the poton the window sell in the approved fashion of our neighbors, where to all appearances it was an innocent put forever cooling off Nobody ever caught on.

The floor plan of the apartment shop is shown in Fig. 2. (Continued on page 100)

A New Handy Tool

—for Home, Garage, or Shop

Handy Block and Clamp No. 751



This Handy Block and Clamp No. 751 has hundreds of uses around the home, garage, or shop. You can use it as a V Block and Clamp for holding round work firmly for drilling, milling or grinding. You can use the Block as a vise for holding rectangular stock to be filed, countersunk or bent. The smooth flat surfaces may be used as anvils for riveting and similar operations. The holes in the block permit drifts and drills to project through the work being held.

The Handy Block and Clamp will be found the handiest tool for many an awkward job. You'll find new uses for it every day.

Ask your dealer for a free copy of BROWN & SHARPE Small Tool Catalog No. 30. Keep it in your kit to use as a reference when buying tools. If your dealer cannot furnish a copy, write us direct.



Brown & Sharpe **TOOLS**

BROWN & SHARPE MFG. CO.

Providence, R. L. U. S. A.



PHIS new 4° electric drill placed on the I market by Millete Fells Company during the present year has created an unusual amount of favorable comment from the consuming trade.

The experience of nearly sixty years in making of high quality tools, including hand and breast drills, has been incorporated in the manufacture of this drill. From a performance standpoint we welcome the most severe test.

Rugged construction; locobe heavy duty teil brushes, Universal motor; a design that feels right in the hand; weight 5% pounds.

Ask your hardware, mill supply or auto accessory dealer to show this new tool toyou.

MILLERS FALLS COMPANY Millers Falls, Mass.

9 80. Clieson floret Chicago 28 Warren Street New York Manufacturers of Mechanics' Tools, Hack Same and Automobile Tools



OF KEILO

Football Marker Shows Progress of "Downs"

By HAROLD J. MACDONALD Arm York Military Academy

NY young football fan can win the A esteem of his team and the game officials by making a "down marker" like that illustrated.

The marker is used by the head linesman, who strikes it in the ground at the place the ball is put in play and turns it so that the number of the "down" is facing towards the officials. The officials and spectators are able to see what "down" it is and then can judge easily by looking from the marker to the yard-



Marker indicates what "down" it is said how for the ball must go to make a "dret down"

sticks how far the ball must be carried to make a "first down."

It is easily constructed out of a piece of pine 4 by 4 by 6 m. and an old broomstick about 40 in. long.

hand the center of each end of the block by drawing diagonass. With a wood bit be in smaller than the broomstick, here a hole lengthwise through the block, bornig from each end and keeping the bit straight. Measure down 10 m. on the stick, cut a biom, shoulder all around, and sandpaper from here to the top. Drive the stick into the block up to the shoulder. Sharpen the other end to a

Paint the bead white with black numerals 1 2 3, 4 on consecutive actes. Decorate the shaft in the club's colors. The part above the head or handle may be shelincked and wound with adhenve or frection tape

A Shop in 4 by 7 Feet

(Configured from Juge 32)

which explains itself, save that it does not show a small confitershaft which was mounted between the engine and the lathe.

Figure 8 (below) shows the south elevation of the apartment shop. Two by four planed timbers were secured to each beach and screwed to the sides of them as shown, so that these uprights were about 1 m, away from each wall. To these uprights were screwed all closets and shelves, to avoid marring walls and woodwork.

For recreation I made many thingsthermometers, hygrometers, and an anerost barometer. The metal for the vacuum

chamber for the latter was spun on my lathe, but the sur was exhausted with the help of the physics department at college.

I made several ateam engines and once. for a dinner party we were giving, I devised a table fountain with a real little power house under the table. In it were the motor and pump driven by a small storage buttery, which also lighted upthe power house. The fountern was quite a decorative affair with a basin made of an English per tin painted blue. In this were goldfish, and about the fountain there was a garden effect of seats and hox bushes. The pump, though efficient, leaked as all toy pumps do, and, as I had used a green blotter for grass under the power house, the blotter became somewhat damp. The green color runed the dress of one of the beautiful ladies at dinner, but it was a good fountain.

Here, too, I did much tinkering with small model steam locomotives and we had a track which ran the whole length of the spartment. I very well remember the vosts of

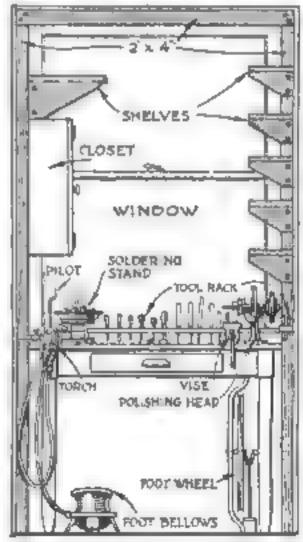


Fig. 3. The main workbench with vise solder ing stand, polishing head, and tool racin.

a famous cellist who would always bring his thick gloves along to handle hot steam locomotives.

Though much of the work done in thus tiny shop was for recreation, I did many a piece of real work in it, and my tin can toys were invented there. Those toys, I am happy to say, helped many a wounded soldier back to some measure of happiness and occupation.

Next month, in the last of this series of articles, Mr. Thatcher will tell how he makes his famous tin can toys.

Sleeve Bearings Save Work for Amateur Mechanics

By HOWARD GREEKE

THE sleeve type of bearing is one that is not used so much as it might be by amateur mechanics. In it the rotating part is mounted on a sleeve, which forms the actual bearing and rotates on a stationary shalt. Such a bearing, if properly fitted, works well is digable, and can be kept well lubricated.

A granding head which was built on this principle will serve to illustrate the idea. The standard itself can be made of cold rolled strel heavy enough to have the everassite stiffness; the construction is such that the standard will be a good deal stiffer than the same thickness of metal with orthuary journal bearings. The steel is bent and riveted as shown, and holes drilled in the feet as may be necessary for holding-down acrews,

A length of atect shafting or drill rod is thread ed at both ends provided a od with two nuts and two collars. The standard is druled and tapped on one side PLOS so that one end of the shaft can be repewed in. while the other ande la drufed with a hose to



Typical example of a emell sleeve

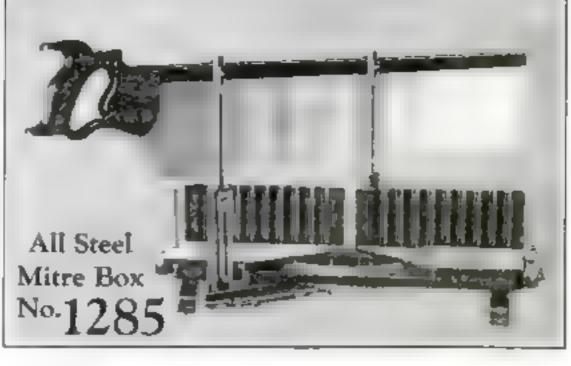
event the shaft; thus the shaft can be passed through one hole and screwed into the other. The collars go made the standards and are held in place by taper papa, which can be driven out without much trouble when recessary.

The sleeve may be of steel or hard bruss. ordinary brass toling will do for very ight small work but is too soft for heavy jobs. An execlent material for this purpose is the beside at ppaies in the facility. cored bars for making automobile at ! other business.

THE sleeve is drilled and reamed to an exact fit on the shaft, and the driving p they and the emery wheel mounted upon at in any convenient way. Carn should be taken to have the outside accurately concentric with the bore, or the pulley and the emery wheel will not run true. The length of the alcove is equal to the distance between the inner faces of the collars primed to the steel shaft,

A somewhat simpler way of mounting the shaft is to slot the standards down to meet the holes and insert the shaft by amply dropping it down the slots with the collars already in place and puned, and then tighten the lock puts. In any case use stout pins, as they have to take the pressure of the lack nuts.

While one oiling will last a long time and an ordinary oil hole with a spring brass cover may be used, a particularly good lubrication system may be made with of holes and wicks, as shown



So Easy to figure any angle with this mitre box

HIS Goodell-Pratt Mitre Box figures your A angles for you. Not merely 45 and 90°, but any angle you want.

If, for instance, you want to cut a beam or rafter to rise 4 inches to the foot, just set the indicator on the scale to 4-and you're all ready to saw.

Simple-quick-accurate. Saves you time and trouble and possible mistakes. No skill needed to use it.

No. 1285 is all-steel—the only all-steel mitre box made. It is trussed like a steel bridge. It won't bend or break.

The bottom plate is scored, so your wood won't slip while you're sawing. Both length and angle attachments provided. Fitted with first quality Back Saw.

You won't know how easy it is to cut arry angle with absolute precision until you try thus No. 1285 Goodell-Pratt all steel Mitre Box. It is sold by good hardware stores. Its price, complete with 28 x 5 in. saw, is \$27.50,

> GOODELL-PRATT COMPANY, GREENFIELD, MASS., U. S. A.



MAKERS OF MR. PUNCH

Write for this FREE BOOK of good tools

Our Catalog No. 16 pictures and describes the Goodell-Pratt 1500 Good Tooks This book is valuable to the handy man and home mechanic. It's free. Write for it now.

GOODELL-PRATT 1500 GOOD TOOLS

Contentment in Every Draw— Cards or Tobacco

A new slant on pape-smoking contentment is brought to light by Mr W H Doughty, a furniture dealer of Greenville, Tenn.

Read what he writes

Lorus & Bro Co., Richmond, Va. My door tires.

For twenty verte I have been engaged to reter one turniture. On many days my my stope on I a I appended our friends filled a vite them down to a little point game.

In this quasings of my salection there-improved to on a fet w by the name of And he is talected denier. This feture Austine was a most consulers have but

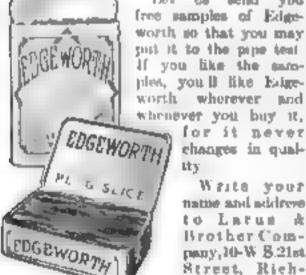
His conduct because a study with me My winning out losting a sain were re-flected in my school. When winning, Sectors in my detrous. When seinning, I was the good follow. When Josing, I was the greath. All this time I noticed Mr. Amaric the telegraph is leaved as in page - companies of manifest of basis of the page - companies of manifest to make the page -

Finally least be matter up to Mr tention for a solution, the set I, "Major tray polar title by brevets, there is no security to the brevets the matter to the brevets to see I a see a. When I used a freed in polar or break see—22 (as set less never failed ing. It carries consens constant as a regular security of the partir range as or ha

The next true I visited the Muses Current Tobarco Shop I purchased uses of the Edgeworth. It has made a new man is of an I can good there in the tape well and whatther true pagested by

Biography.

W II Doughty



Let us send you free samples of Edgeworth so that you may pull it to the pape test If you like the monplea, you il like Edgeworth wherever and

> for it never changes in qual-

Write your name and address to Latur & Brother Company,10-W S.21st Street, Richmond, Va.

We'll be gratuful for the name and address of your tobseen dealer, too, if you care to add them.

Engeworth in sold in various sizes to suit the needs and means of all purchasers Poth Edgeworth Plug Slice and Edgeworth Ready-Rubbed are paced in small, pocketsize packages, in handrome humidors holding a pound, and also in several handy inlyet ween same.

To Retail Tobacca Merchants: If your jobber cannot supply you with Edgeworth. Larus & Brother Company will gladly send you prepaid by pareel post a one or twodozen carton of any size of Edgeworth Plug Suce or Edgeworth Ready-Rubbed for the same price you would pay the jobber

- On your radio - time in an WRVA, Richmond, Va. }- 1- the Edgeworth station. Were length 216 meters. }-

Toy Parts Used in Making a Light Fret Saw

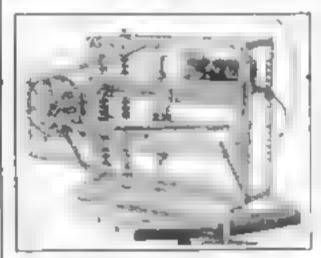
BY ERNEST BADE

"O MAKE a light fret saw with motor drive is not difficult. The one illustrated has given surprisingly good service for a long time and is admirably adapted for all kinds of fret saw workmaking toys, games, puzzles, inlays and

marquetry,

A pair of rectangular frames of equalsize are no fastened logether that the vertical one lies in the center of the horizontal one. In the center of the vertical square, a table is firmly fastened The frame must, of course, he rigid, whether made of toy construction parts, as in the saw shown, or of wooden strips,

The moveble frame carrying the saw is just as wide as the main vertical frame but only half its height. The four outer



A rectongular frame, driven up and down by a motor curves the binds of this feet onw

ends slide in ways made of thin paper or rods fastened to the vertical frame.

For raising and lowering the saw frame, two long levers connected by a vertical rod or strip are required. The fulcrum is located on the main vertical frame at about one quarter the distance from one end. The movement is produced by a short strip attached to the lower lever and to the outer run of a wheel, which is rotated through the medium of a belt and a set of reducing gears. A small sewing machine motor provides power. In this way the circular movement is translated into a perfect up-and-down motion.

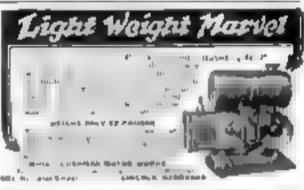
Fastened in the center of the movable frame is the new, which receives its tension from a stiff spring or tension screw located on the upper part of the frame. If desired, a guard can be at tached to prevent the fagers from coming in contact with the saw while in motion

The blades, which are often called coping saws, can be purchased in various sizes and widths at hardware stores.

A Home Workshop Is an Asset

THE Home Workshop Department of your magazine interests me very much. A home workshop is an asset to any home or farm. I regard myself as fortunate in having one with a good set of tools.-W. H. McK., Sibbald, Alberta, Canada.







Ship Model Making

How to Make Worth While Models of Decorative Ships

By CAPTAIN E. ABBITTAGE M. CANN.

A practical book which tells how any handy person can make models of a Picturesque Barbary Pirate Felucca and a Beautiful Spanish Treasure Galleon.

Ship Model Making given full-sixed drawings of every part required. This book describes how to make the models, what materials to use, how to fasten together and color them, how to make the spars and ng the ships. You do not need to know ships to make these models, the book describes everything in detail, but you may use your ingenuity and actistic sense in decorating and can make them larger or smaller than the scale given.

Profusely illustrated—Scale drawings

Price, \$2.50

POPULAR SCIENCE MONTHLY 250 Fourth Ave., New York Chy.



🙆 This seal on a radio, tool or all burner advertisement eignifies the approval of the INSTITUTE OF SYAMMARDS. See page E.

Making an Auto Look New

Continues from page 67,



Fig. 4. Top dressing may be applied with a brush or with a wool faced shot polisher

I had made up a some solution by chipping up a five-cent har of a popular brand of floating white soap and dissolving it in & gallons of hot water. By dipping an eighth size sheet of No. 00 water sandpaper—that is, sandpaper made to be used either wet or dry-in this soap solu-Lon and then manding the old finish, we were able to cut fast aixl clean.

I explained to Dan the necessity of working carefully around the moldings fixtures and handles, although we took off as many of these as we conveniently could. We worked until everything was e can aird glass smooth. We gave especial attention to several sage left in the old finish, more we knew that traces of these would show on the new surface if they were not cut down with the mudpaper and soup solution

The hood we took off and laid over two tall anwhomes as order to have it hands for water sanding and to allow us to flush. it off with the hose. The engine was covered with heavy burlap to prevent water and grit from getting into the

"Wouldn't it be a good thing " asked Dun, "to wash the bood made and out with gasoline to get off the dirt and grease. before we said st?"

" NTO, Dan, it wouldn't. I was overly careful about that once and got into a peck of trouble. It seems that the gasoline spreads a film of oil from the under ade all over the top to be variabled. and no amount of sanding or acrubbing will take it off. When it came time to varnish the bood, the enamel slipped and crawled so that the hood had to be stripped in a hot caustic solution clear to the metal. For a job like thin all that is necessary is to clean and sand the face side very carefully and avoid anything which would get any maide bood dirt or grease on the outside "

We then continued with the scap solution and sandpaper, taking special pains not to cut through to the metal on door edges and moltings. It seemed best to sand in straight lines, parallel to the floor (Fig. 2), although (Continued on page 10),



Seldom counted in-

often counted out - perhaps it's comedones*

Dinners, dances, theatre partiessuch social activities were seldom Dick's. Evenings usually found him home, alone. Dick couldn't understand why Tom got so many invintions - while he got practically none. Not for a moment did he guess that the reason was comedones.

A great many young men suffer from comedones-commonly caused blackheads. Skin can't be clean-looking, fresh, wholesome, if these disbguring formations are present.

What's more, you may not even be conscious of comedoner. But your friends notice them. You may wonder why mynthnons become fewer-why friends-girls in particular-seem to avoid you. You may never guess. Perhaps et's comedoues.

Pompeian Massage Cream helps you overcome comedones. It gives you a clean, clear, ruddy complexion. It gets into the potes where comedones form, solls out all dirt and oily secretrous, and sumulates a healthy circulation, keeping skin clean, potes open.

Try this treatment

After you abave, aprend Pomperan Massage Cream generously over your face - and rule Conunce to rub until the cream rold

out. Nore how dark the cream looks. That's the dire that was in your

No need to have a dirty skin. Don't let comedones form. Use Pompeian Massage Cream every day It means a healthy, wholesome skin, le menna more joy to bying.



Use at Home ofter Shawing

To get full pleasure and benefit, use Pempelan Mausage Cottom regular i at frome after charms. Your face will feel and only like a mile

SEND FOR 10-DAY TRIAL TUBE

hence i is olien caued buckhead.



For 10c we will send a special trial tube concurring sofficient cream for many delightful mussages. Positively only one trust tube to a family on this exceptional offer. Use this conpon now.

*WHAT ARE COMEDONES! pronounced com's-dones-

Department definition. A small plant or mass occluding the excretory duck of a scharceout gland, or arrang frequently uson the face extremally the noise and a mission of terained seem liquid glandula, as receive a school frequently of each of the contraction of duck and dury

Tear off, sign and send

The Pompeun Laboratories, Dept. 53 Cleveland Ohio.

Gentlemen I enclose a dime 10c) for a special crist. rube of mateurs cream.

Name

Address

Caty

. State.



"It's a Maydole"

A man is just as proud of his hammer as he is of his most expensive toolswhen it's a Maydole.

The Maydole Hammer is the result of more than eighty years devoted exclusively to fashioning fine, strong, beautifully balanced hammers. Only selected tool steel-press-forgedand clear, second-growth, air-dried hickory are good enough for the Maydole.

Ask your dealer to show you a Maydole in the style and size you And write us for useful wast. Pocket Handbook 23 "B."



Hammer Co.

Norwich

New York



Making an Auto Look New

(Continued from page 200)

small panels between doors were run up and down, and the cowl up and over.

As fast as the work was completedcowl, doors, side punels it was flushed off with the open end of the hose and then chamorsed dry with wash leather, which had been dipped in cold water and wrong out as dry as possible. A really dry chamous will not absorb water.

By this time the putty-glazed spots were hard, so that we could cut them down with the paper and soop solution until they, too, were level with the rest of the surrounding surfaces. After that the hose and chamous were used as before.

"Weren't these less frames nickeled once," asked Dan, "even though they are black now?"

"Right you are, Dan. The nickel is in good shape, too. Take them off and clean off the enamel with variush remover and some scraps of rag so as not to scratch the

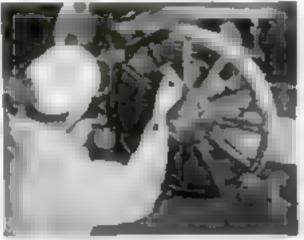


Fig. 5. The wheels were given a root of black larguer. The under ude of fender and shirt had a cost of ac-drying turpentine sophehum

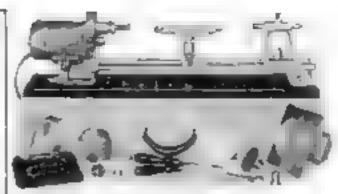
nickel. Wipe dry with a clean cloth and then rub to a brilliant luster with a fresh eng wet with denatured alcohol and dipped in dry rottenstone. When the frames are polished, wipe them with a clean, dry rag so as to avoid touching the metal with your fingers, or marks will develop under the new coat of clear lacquer. There, that nickel is as good as new! Bet them asule on this clean newspaper."

Our next job was to mind the wheels, We had previously jacked up the frame on the winter storage horses and taken off the tiees. We used a fine uplit paper and cuffed off the wheels as smooth as possible. Then Dan flashed them with the hose and dried them with the chamous.

While Dan was washing the wheels, I sanded down the enamel on the radiator shell and bumpers so that they, too, could be treated to a coat of lacquer along with the rest of the job.

"Now we can take it a bit easier," I said to Dan. "Suppose we lacquer the lens frames first, since the brush is clean and fit for clear lacquer. For this work we had better use about one quarter thinner. so that this one and a ball meh fitch brush can flow out the lacquer amouthly and Ireely (Fig. 3). See what a fine job that

"While the body in drying ready for bequering tomorrow, we can dust off the top of the cur (Continual on page 105)



A compact and efficient electric work shop for the man who loves to make and create handswork. Driven by the famous Speed-Way Motor which is interchange-

8 Motor Driven Tools

A complete woodturning latin, bench atwo-scraft or jig law, a so table one rie hand and and all accessores for high partiagle are who some any sewer drilling, burning, grinding and cleaning. Attaches to any light one a prior in the law a six beach data a counterp priorit food and more he said. Have the chape flying in five nanusce after receipt

Make Things at Home the furnisher fortell or and decorations, go and place such a quantity of experimental point in mallo spartness diversions and countries other techniques.

Only \$10 Down

Our Bierature covers condifferent assentidate d Naval-Way Shops and fou un di efect e Aperini den Between an indebt ed or insent me you destine their payment bjan meyes oamini e spale

10 Days' Trial

You can test this along for O days to your own hours. I's des sleen than we claim denia na lo-

WRITE for full

Every tool is high grade for Free Blue Prints regula work A shop to a though maker for the anal-rel tests. Write for our plete information

Wet e in ust of work-ing due permanent we to make tree with such else vie along Electro-Magnetic Tool Company (#30 5.53 nd Ave., Cleard, III. (#4) of stragg)

Manager, Dept 511 Please mad me particulars about 10-day from trial, from blue-prints and 510 down phyment.

Name

Address



Old Laths Converted into Flower Boxes

MANY of the products of our bonie workshop are the result of a development of an idea, rather then the execution of a definite plan. Do we fully realize the wealth of thusof getting the most of what we have?



Two of the boxes

The illustra-

tions are descriptive of some really decorative porch boxes, easily made of old lath. Nasled as they are cribbed, the pieces of

LAPS HA

BASEBOARD, , HK. K.

How the lethe are fagrened together

lath form a rigid COIS WORK OF UNTH protecting case for the pot contamout the plant or flower It is, of course best to pan t the lath with the busy rolar before they are maded. FRANK W. BENTLEY

Making an Auto Look New

fundament from page 104

and apply a cost of facquer top decising My experience has been that the cheap type of on top dressing maps to gather too much dast. In the factories the dressing is applied with a glove faced with a clean wool fleece, but if you prefer, you can put en this first coat with a brush (Fig. 4). Start over in the mindle of the top and brush down through the center parallel to the side of the car, working with a left to right atroke from the raw surface to that just painted in order that the brush stroke may be properly 'feathered out' and not show laps. You go ahead with that work. Dan, while I do the wheels. If you have the time, dress the cushions and seats. tao."

On the wheels I used a 134-in, full chisel fitch brush and found that the black lacquer produced a fine, amouth job because of its self-leveling properties. The strokes were started from each end of the spoke and carried toward the center and the work was carried around each segment of the fellor as fast as the spokes were completed (Fig. 5).

Almost before we knew it, the five o'clock whistle was blowing and work

must stop.

"Not a had start, Dan," I saul. "Sprinkle the floor and sweep clean. Then tomorrow we can come over and get our main lacquer work giving in good shape.

Next month Mr. Waring will tell how he and Dan Snished the job. Instructions for lacquering woodwork were given in the August and September issues.

TRADE AMARK

DOOR CLOSE!

are Door Controlling Power Plants



As the door is opened the power of a highly tempered steel spring is stored up, waiting to be released. When your hand lets go of the door-knob the spring unwinds, promptly starting the closing action. which is controlled by a parton working within its cylinder against hydraulic pressure.

Make your doors complete in their functions. Enjoy the comfort of knowing that they will always close gently but surely and always under perfect control.



Write for our booklet, "The Silent Doorman."

The YALE Power Unit

Made under exacting specifications as to length, thickness, width and winding. Assures effective and constant power. No deterioration in efficiency.

The YALE Forged Crank Shaft

The crank shaft is made of one piece of drop-forged steel of great strength and rigidity. After being machined, it is carefully ground to dauge to moure a perfect fit.



The YALE Connecting Rod

Unusually beavy, attached to the puston by a large pur. Its construction climinates the tendency to tilt, preventing constant wear and leakage. The YALE Regulating Value

Allows simple and positive control of

ag speed of the ages under all conditions. The valve is slightly below the center line of the cylinder, insuring a smooth automatic checking action.

THE YALE & TOWNE MFG. CO.

Stamford, Conn., U. S. A. Canadian Brunch at St. Catharines, Ont.

MARKED IS YALE MADE

Ever notice?

SOONER OR LATER most men reach a point, in everyday matters at least, where price is no longer all-important. They begin to look around for "something better," And it is by no means an accident that just at this point so many men turn to Fatima



"What a whale of a difference just at few cents make?

LICOUTT & MYESS THRACCO CO.

See New Financial Department on Page 4-front section.



FOURDED IN IRES BY J. W YORK

GETTING AHEAD?

Ruad the advertisements on Pages 134 to 167 this issue if you want to get shead.





This Toy Dirigible Looks Astonishingly Real

BY DONALD W. CLARK



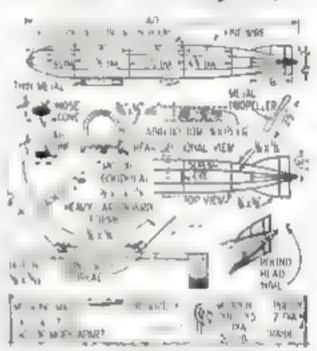
the realistic am atractip as this will delight any child, just it can be built quite easily

T IS not hard to build a realistic mint nature dirigible that will give the children much pleasure.

The framework consusts of five heavy cardboard formers, octagonal in shape and notebod at the points to take long strips of 14 by 14 in. wood. The nose and tail cones are whittled from soft pine. The cabin is of thin metal tacked around a wooden builtom cut from eiger-box wood.

The motor gondolas, of which there are two, are shaped with a pocketknife and sandpaper and are fitted with metal propellers.

The frame is covered lengthwise, one



How Improverk is essembled the cabin and motor gundales a suggestion for mooring masts

section at a time, with tough paper or thin cloth, well glued on,

By concealing the mooring musts behand abrubbery as well as can be done and using were so thin that it rannot be seen at a short distance, the airship will appear to be floating through space under the own power. A slight breeze will cause the propellers to turn realistically.

A Non-Slip Miter Box

VUTTING a large number of pieces of wood in a metal inter box is tiresome because of the tendency of the stock to slip. The work may be made easier

by gluing or cementing a strip of sandpaper or emery cloth to the bod of the unter hox, as plustrated. Thus applies to both split and onepiece bottoma,-F W. HARTH.



The metal bottom is covered with abrasive

On the Trail of a Burned-Out Fuse

By George A. Willoughby. Superouser of Electric Work, Arthur Hill Trade School, Sagrame, Mick.

"X OU bet I'm through! No more I trying to tioker around with lamps, flaturous, or anything electrical for me!

Jack Rice, my next door neighbor, was so combatic about it that I could not belp amaling.

"What's the trouble?" I seked

"The wife wanted me to wire up a bed lamp also had just decorated with a fancy shade. I did a fine, next job of it. The only trouble is that the lamp won't light, Neither will any other lights in the bedroom, sewing room or hall."

"What you did was to blow a fuse in the circuit leading to those rooms and the

hall," I said.

"How did I do that?"

"By allowing the wires in the cord of the hed lamp to touch each other. Perhapa you cut off too much covering or



A lamp is pieced in one receptacle of a four block: the adjacent receptacle then is used for testing the many foom the necessary

didn't remove the excess were after you made the connections. You'll find a short circust somewhere. First we'll disconnect the lamp; then we'll locate the blown fuse and put in a new one."

If my neighbor had used only fuses that gave visible evidence of being burned, it would have been no trouble to replace the uncless fuse, but there were few class. The fuse blocks were not labeled or charted in any way. It would have taken some time to discover the fuse, as is so often the case, if we had not gone about the matter systematically.

First we turned on a light in the living room so that electricity would flow in this carcuit, which was all right. Then we took a bulb from a fixture and went to the

The idea now was to try the lamp in place of various fuses in the fuse box until it lighted. We should know then that we had it in the living room circuit. There were two advan-(Continued on page 108)



Handlest Tool in Your Work Shop

Printed was have more it ghood the special as a tagen of may as Parent 1 - point of a section to be specially as a section of the that the second



Recipe for making LePage's Gesso

To Make one cap of LePane's Gener, you need a gall can of LePane's Citue, a copy what og, a compound maked of transforms was ask. g compressions assert of and g franciscome variable. Place what again the mag be at and took in the wife to the time to be LePage's time. Imperior of and Mrs until smooth A" obtainable of nearest hardware store.

LePage & Craft League Dept. on Gloventer Main. Gentlemen England you will find to tents our or slamps or payment for the Page t Prortscal Suggest of the Home Workship and LePage t security at Book. Sease send acopy of each in Name Street City State

Something NEW These new LePage's Books will show you how to make better **CHRISTMAS GIFTS**

OW with the coming of the holiday, gift-making season, when the man who has a home workshop especially enjoys his bobby of making useful, practical gifts that can be used and appreciated by everyone in his home-come these two NEW LePage's Craft Books to show you how to make better Christmas Gifts and how to improve s or craftsmanship. The titler of there two books are, "LePage's Practical Suggestions for the Home Workshop," and "LePage's Gesso-Craft Book.

Naturally what you tacks the making of an a tack like a breakfast pools, slup model or an a racte like a brankfank pools, ship model of an all chart. You want to came as sear as post of the provide at the provide at the things which he knows to make the at the things which he knows to make the things which he was to make the things which he graveful is so and beauty. The only way to do have a win the take of gluy and thin is extended to the make the major and thin is extended to the things way to do have a win the take of gluy and thin is extended to the major at my point with give and much to we give a with give a most consequent for a belieful to bequided.

Improve your Craftmanship

The so has he also show you have to cover up as all the to the big and an error is made. It is not to a place gradup. It we and the a to well and and an error is made. It is more color to be fulled where made is a point are not east to even. A simple new way to be paint these to extain a with the one of hellage a feems matered of potty. Lellage's Grams will stock to any satisface—wood, metal, plane, etc. It can be unadpapered, planed and painted or stained metals are not be given you in the magnit point below a sample formula for making healings a second back of course we tell your many about it in the braids themselves together with less that off course we tell your many. he total enternation of decorating your

Send 10 cents for these NEW LePage's Books

The practical and unclud belo of these two beside as yours for only to contain just write you make and address on the unopen below tear the coupur out and mains to to us to tay with to reals in our or stance and we will at once send rous a copy of hose two LePlage's Blooks, p stage part. Address Lel'age t Craft strague. Dent nos Charester Mass Tea ut the coupon now so that you will not longer of. Ten mi the

Bottles, Tubes, Cans

Make Their Mark and Toe It!

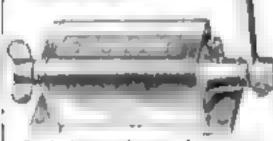
Machines will do the best they can do only when checked-up by Counters.

They make their mark for production-speed and "toe the mark" only when watched by Counters.

You can hold them to their given capacity, and straightway develop greater capacity, by perfecting those mechanical features which "COUNT" on your



The large Revolution Set-Back Counter below records the output of any machine where a shall revolution indicates or approached.



Sets back to zero from any figure by turning knob once round. Supplied with from four- to ten-figure wheels, as required Price with four-figure wheels, as illustrated. \$ 0.00 subject to discount. Cut less than enachalf also. Set-Back Rotary Ratchet Counter, to record reciprociting movements as on presses, \$1150 last). Smaller counters from \$2 up.

Speed Counter

Here's the handlest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against and of revolving shaft. press lightly when the second hand of your watch comes to 0; release pressure when minute is up. A spring chitch controls the recording mechanism.



Cut loss than 1/2 star

The Veeder Speed Counter enables you to keep motors, engines, generators, line shafting and machines operating at effiesent speeds. Price, with two rubber tips pr dimtrated) \$3.50

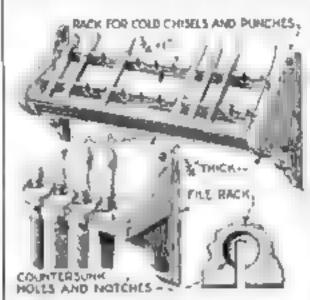
FREE -We'll send you the big Veeder Booklet, Shows counters for all machines and deoulopment-work. Write-

The Veeder Mfg. Co. 44 Sargeant St. Hartford, Conn.

A Rack for Files, Cold Chisels and Punches

THE home mechanic who is proud of has collection of files, cold chusels and punches and wishes to keep them in such order that the right tool may be selected austantly, can construct a serviceable and good-looking tool rack as shown below

The mck for chusels and punches consists of two wonden brackets and three strips about 3(by 1 in. in cross section.



The amoteur mechanic a pride in his mole is coffeeted at beautyful tool atcht auch to these

Two of these streps are clamped together and sawed out to suit the various tools the cuts being from 14 to 4 in. deep. The lower piece prevents the tools from falling out. A back of wallboard is provisted,

The file mack is a strip of wood by by 3 in, with holes 135 or 155 in apart. A saw cut from ५ to 🦙 in. wide ruin into each hole as indicated. This strip is supported with small, three-part wooden brackets at the end. Groupe H. CAPPEL.

On the Trail of a Blown Fuse

Continued from page 10 .

tages in this. We could later make a chart and show the location of the living room fuses in the box. And we could now remove the other fuse in the living room fuse block so as to use its receptacle for testing as many fuses as we pleased

We removed the other fuses in the box. one at a time, and lested them in this vacant receptacie. In every case but one the adjacent lamp lighted. In the one case we knew we had discovered the fuse which has been burned out by Rice's faulty wiring; at the same time, we had located the position in the box of the fuses in the bednorm mont

" hou can see what a simple matter it. is to chart the fuses, even in a large fuse tiox," I remarked to Rice. "My only suggestion is that, if you are not on a wooden platform, you stand on a chair or a box when you change a fuse, to keep you off the ground. Another safety measure is to open the many house awitch every time you screw a fuse in or out."

How to prepare a detailed fuse chart will be explained by Mr. Willoughby next mouth.



Pend coupon for Fig. 6 bargain catalog 1 apining our new casy method and phose everything to highest crade I tembing that of a thing of the pend of th

FREE Masaing Berrire Atl-Carl Papelots Corners

Artical Paperson Farmers

Ford on a residual photological processors

and he will have be found in the reof function Plan or foundation for

finding for depociable on the processors

house, forther article in this per side.

No eight this for ill substance forth.

With our stoughtful plane and forther

many mathests on many the time. easy method you man do the the starting. We have need \$16.15, but Heinfield current seems looked by Nithers Buillor Plant, and 50 Years on Disassess. HARDIN-LAVIN CO.

the fact that he character was a second with the course of floring Pant J Plumbing du. 51

CONTRACTOR

FIXED RESISTORS

ARE WARRANTED-Absolutely Noiseless Permanently Accurate Dependable /

Write us!

ARTHUR H. LYNCH, Inc. Manufactorers of Radio Devicus

Fisk Bidg., Broadway & 57th Street New York, N.Y.

SANDERS OF THE PROPERTY OF THE





See New Financial Department on Page 4-Front Section. was the same

A Kitchen Cupboard

(Continued from page 78)

at various angles, but out of the way of the notches to be cut where the shelf fits around the corner posts. The back notches are 14 by 114 m., the front, 14 m. by 14 ut. When dry, surface the joints smooth.

The construction of the lower upper section shelf is much the same, except that it is wide enough to come flish with the front of the cabinet, and the front notches engage with the post mortise while it is mortised to receive the mintintenon.

The two drawer rails are as the lower unner section shelf without the panel veneer and rabbets, and notched to receive the lower maritin.

bur the frame of the countershelf, ? by it in stock sized to 13g in square is

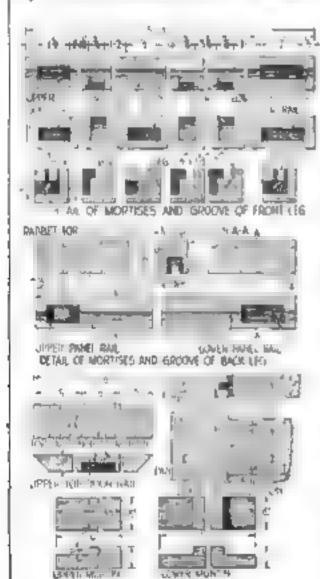


Fig. 2. Details of the front and back legs, the mention, the upper frunt rail, and the doors

used, and the rabbet is 14 in, wide, but the construction is otherwise the mane. Work a tenon on each front corner, as shown in the detail. The lower edge, 34, in, from the front, is mortised 1/4 by 11/4 by I in, to carry the upper tenon of the lower mentin.

Make the munties as dimensioned in Fig. 2, of 11/4 by 11/4 in, material upped from a 4-in, buard, and assemble the sides with the top and bottom front rule and the countershelf. Slip in the shelves and drawer rail assemblies from the rear, gluing the joints, drive brads through the sides to secure them, and glue and pail in the back panel, which is cut & ft. 10 1/4 in. by 5 ft. 11 1/2 in. Every 8 m. drive a fourpenny finishing (Continued on page 110)

adlevonm-E PERFECT VARIABLE RESISTOR



EVER since radio broadcasting began, Allen-Bradley Radio Devices have not the dumad. Lor allent, supless current control. Today, Bradleyohm-E, perfect variable resistor, is not only adopted as standard squipment by manufacturary of B-eliminators, but is recommended almost universally by radio engineers and writers so the ideal variable resistor for Bekanmarar kim.



For a fixed resistance unit. Brudleyunt: A others unusual adventages. It is a solid. molded retistors with allows plated to taland cape than can be epidered without in-jurious the resistor. Since the Bredlemant: A coutains so glass in its construction and does not depend upon beymetic realing for securery, it is manifected by sumperstain, modernes or one.

The scientifically treated graphite discs used in the Bradleyohan-E provide the only means of stepless, namelous control which does not deteriorace with age. Curbon or metallic powders of various kinds have been used as substitutes by imitators of the Bredleychro-E, but without permanent success. Il you went a variable resistance used for your B-eliminator which will give perfect nervice, be sure to ask your doubt for the Bradleyohm-E which to turnished in several. estings. Look for the Bradleyohm-E in the distingave Asser-Bradley checkened curton.

Bradleyunit-A and Bradleyohm-E can be obtained from your radio dealer in several ratings. Junist on Allen-Bradley Radio Droices for lasting esticlaction.

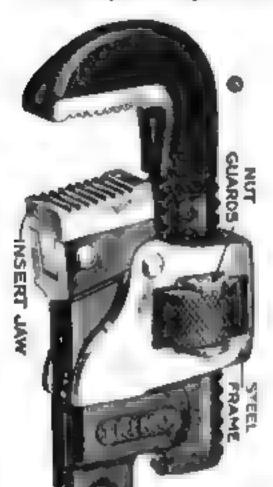
ALLEN-BRADLEY CO



293 Greenfield Avenue

TRIMO

Tools Challenge Quality Comparison!



We never have and never will make TRIMO TOOLS to meet price competition, because after all quality and NOT price determines the value of any tool to you. For nearly 40 years we have been buying the best materiels available and fabricating them, by modern equipment and the highest shalled labor into the finest tools that money can buy.

Thus TRIMO PIPE WRENCH is a oplendid example. It may cost you a trifle more than ordinary wrenches, but note some of the features you get for your money: (1) INSERT JAW in the handle, replaceable when worn; 2) NUT GUARDS that keep the wrench adjusted in close quarters, and (3) STEEL FRAME that will NOT break. Eight steel hundle sizes from 5 to 45 ms. Four wood handle water 6, 8, 10 and 14 ms.

Trimont Mfg. Co. Roxbury, Mass.

Also makes of the femous THRED Mankey Westches, TRIMO Pipe Cutters and TRIMO Figure Vigur-all quality products.

A Kitchen Cupboard

(Continued from page 100),

nail through the side and back panels into the shelves and drawer slides.

Fit a 34 by 2 m. rail between the back posts at the top and a 214-in, rail at the bottom, cut a piece to fit in the disdocs of the lower panel rads, and fit a piece behind the bottom front rail. Fit a veneer shelf in the bottom of the cabinet, and glue up a top of 1 by 12 in. stock, which is sized to allow a projection of 1 in. on sides and front, and nailed through into the upper sade with surpouny finishing nails.

Build the drawers as detailed, tuning 1-m. stock for fronts and 14-m. not stock for the sides and back. Use panel veneer for the bottoms. Bevel the edges of the

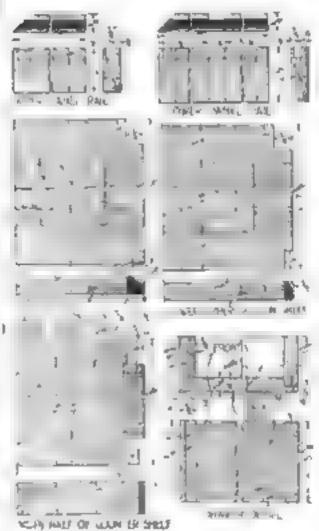


Fig. 3. Details of the upper and lower panel. rade, framework for shelves, and drawers

front slightly to secure a close fit. To gorde the sides glue strips of the necessary thickness to the cabinet index, and give blocks to the back to stop the drawers flish with the front.

The door stiles and upper rails are of 1 14 by 3 m, stock, which, when assembled and surfaced, is 1 in, thick, giving a shelf elearance of 🦌 in. for point. Groove 🦠 by 1, in and cut the panel veneer 36 in. undersize to prevent interference with the closing of the joints. Two 35-in, hardwood dowels in each joint are sufficient.

For the countershelf door, I-un stock rubbetted to fit the grooves is used in place of panel veneer, so that the inside surface is flush with the stiles and rails. The door may be built as the others, however, and the inside panel filled with another thickness of veneer Hinge on the (Contrased on page 111)



Dont, P.S.J. SO Franklin St., N. Y. City

Uses graphite disc restators which are noiseless and not affected by stmuspheric conditions, Metal parts are nickel plated One hole mounting. Finish and knob match Bradleyeur, Made in 200 and 400 ohm

Patings.



273 Greenfield Avenue

Stationary Engine of No Intercept Charges

The Ideal Form The lower Pumps Regime for Pumps and All Parts Chords. The One-Prome ing and All Parts Chords. To You From Factory Lating. Sold Direct To You Forms.

Developes Full Power on KERCSENE, CAS-OIL, GASOLINE, DIST LLATE or CAS, Simple econom-ical and t-ouble-proof, Equipped with WICO Mag-peto, square, protected tank, dis-cast bearings, speed

FREE Write codes for big, Free Catalog and Log and Tree Sews, 1-to-1 Sew Rays of Franço Outlier.

WITTE ENGINE WORKS 111 Witte Building, KANEAS CITT, MO. 1211 Empley Bidg. PITTSBURGH, PA. 1431 Witte Bidg., SAM FRANCISCO, CAL.

Quick ship-ments also made from marrest of 15 warehouses.



CHEMISTS Catalog of TUB AND CHEMICALS

1000 Harmanness reconstitute a citieplete use to mee result for distributions.
Four no recents of the which will be reignoled on two makes for \$5.00 in \$5.00;
We gar abject the bittle warefully of
pactallargy field as your problems.
Conditions of Mans. Input of Tech
I me of Parts. A moon type, and Yalin
Laboratory Materials Commonly
541 East 71st be., Chicago, U. S.A.

November, 1976

Wir Home Workshop

A Kitchen Cupboard

(Continued from page 210)

bottom edge and equip with a desk chain. so that it opens horizontally, forming a Worktable.

Hunge the doors with \$34 by \$14 in. loose pin butts. Fit the doors with 1/4-in. elearance all around, being sure that there in sufficient bevel on the lock stiles to avoid striking in closing.

Finish either with brushing lacquer or with two or three coats of flat paint and one of enamel, and oil the inside, except the drawer interiors which should be left. natural. Screw on small glass drawer pulls, and put a pair of nickel plated pulls. on each aide 314 ft. from the floor when the case has been mounted on the wheels.

Bill of Materials for Portable Kitchen Cabinet

io, Pos,	I	W. 18	4 ft.	Fir, pine m other will
				factors, four agrees
1	2	3	a tr	For corpor
5 2	114	3 3	× *1	For Pagin
2	116	3	1, 16	her dund at the de hipperton
ı	114	4	le Ir	there were
L	1	4	6.4	For strawer
*	26	6	100	Par desem- motern new- bill be-
à.	76	(B	Q II	a-tily fir pair
1	И	210	0 11	Septy for a panel we have
l.	76	BG-	2 ft.	and the part
4	4			linbier are.
R	14			Chan raw
4				Necks white or drawn pulls
4	36			Pall appear
å pair	11.1	974	2)4	Deek clean Lones pix h a k t :
415 300	ومرة أساده م	l-	. to all an	(himmer)

Special Mounting Allows Fingulation Be Lowered

FTER experiencing some difficulty in A painting and in keeping a rope in place on his flagstaff a building manager in

Indianapohi put up a pole that can he lowered easily when necessary. It is of tran pipe, S inches in diameter at the base and 11% inches at the top. The method of supporting the fingstaff is illus-trated.—S. E. S.





The Amplion Particles commission a personalist of all rotums, with excelered Amplion until the Schlerested Releasely calinet. In 1274 97 of solvened contours and gracely and world beauty that harmonise perfectly with with modern, lunguous home appointments.

The new Amplion Patrician reproduces the very soul of music

-exceptionally rich in those delicate overtones that give to music its temperament, its true character, its tonal color, its sensitive appeal to the spirit.



AMPLION CONE

Animically, the new Amplion Cabines Cone street the most enquisitely appointed room of two-tone managent, 14°414°49° Acoustically it is a time perfected Amplion development, estiling th entirely new standard in radio recupion. AC12 ...



AMPLION DRAGON

of all the lament Dragon 1700 of Amphona, adapted as mandeed by leading radio engineers wherever broadcasting exacts. Notable for wantitisty to even the faintest speech and musical signals, and for amoring volume. AR19. Other Drager, madels from \$17 to

VOU may own the most expensive radio 1 receiving set. You may tune in on the best radio concerts. Yet, if your reproducer is not delicately and accurately constructed, you will lose most of the fine overtones that create the true beauty—the very soul-of music.

Since 1867, engineering experts of "The House of Graham - the creamer of Amptions - have been achieving constant improvement in sound-reproducing devices. As the result of this long experience. It is not extraordinary that the Amption instruments will reproduce more of music a fine overtones, and a wider musical range, than other apeakers are able to do.

The handsome Patrician is the most recent development of the world-lamous Amplion air-column type of speaker. Accustically, it is non-directional, to the notable Amplion sensitivity and clarify it adds a new softly diffound melformers of tope that makes this instrument the choice of the conneisseur, wherever heard.

Write for the interesting "1927-Amplion" Booklet

This model is the best known THE AMPLION CORPORATION OF AMERICA Suite M, 280 Madison Avenue, New York City

The Amplion Corporation of Canada Ltd., Toronto.

"The House of Coulom"—Alfred Craham & Company of London, England—to known throughout the world, three—, its amounted grouper iss.



The LYON&HEALY is so popular because its easier to play? Wm. Haines

OW I kanw why the Lyon & Healy Saxophone is to papuar with men in high school and college. It's easier to play No long weeks trying to learn, Just a few short lessons on the Lyon & Healy Sax and you're ready for the orchestra "

Wm. Hainet, popular Metro-Goldwyn-

Mayer screen star, here of "Brown of Harvard" and "Tell it to the Marines -he knows what he is talking about. Why should you envy the other fellow his popularity, good times, leaurs, extra spending money, when you can enjoy the same things too?

Easy to Learn Our Way You can quickly learn to play a Lyon & Heavy Saxophone because-with our sixty years musical experience to guide us-we have simplified the fingering, made it easy for The Lyon & Healy is the choice not only of noted amateurs like Wm. Hames, but of leading professional players as well, because of its extremely accurate adjustment, improve-ments in key action for hairtrager finger work perfection in pitch and resonant and mellow tones. Remember-It is made and guaranteed by the work famour music house in the world!

Free Instructions I

Mall us the compan helice and we will include IRIT with your Saturthone the same new and amagingly simple Course of Written Instruction which Wm. Hames received, enacting you to learn quickly and easily. This course is brand new. No other music house can offer saything like it-and it is yours-FREE with a Lyon & Healy Saxophone

You Can Pay as You Play
Now you can nwo one Many more mough playof these wonderful in- ing for dances and panirely and pay in les to piect the payminal instalments at the
rate of only a
free rents a day.

Don't delay! Juli detalls Bont delay! few cents a day,

Everything Known in Music

248 South Wabash Avenue

Chicago FREE! This fascinating on saxophone playing.

Use Coupon Today!

LTON & "IF VLT Inc. Factory States Directors

218 %. Weinsch Ave a consign sales proposed and 218 %. Weinsch Ave a consign proposed on the FR E. full information recentling your nexts offer on he famous lying & Health As a plantage and your next next profit for flamphage the unities for pleasure and graft, for flamphage

Name BITMI

City.

Miles Co.

Best Results from Our Five-Tube Set

(Continued from page 74)

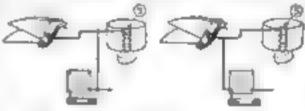
you are located 100 miles or more away from the nearest good broadcasting station, the distance-getting ability of the receiver can be improved greatly by the use of the new 200A type tube in the detector. socket M3 in place of the 201A type tube. Better results are obtained with the 200A tube if the wring is changed according to the diagram on this page. No other changes are necessary.

You will find it worth while to use the 200A tube if you are compelled to use an indoor antenna or your location is unfavorable for radio reception, as it is extremely acoustive to weak signals.

The best antenna for the new receiver is a magic were about 100 feet long and as high as possible. If you find it impossible to put up an antenna as long as that, come as near to it as practical, considering the limiting conditions of your location. A good indoor antenna can be made by stranging 30 or 40 feet of ordinary bell wire around the picture moising from one room to another

EXPERIMENT with the setting of antenna switch B' until you find the point that gives you the strongest aignabconsistent with good selectivity.

After the tubes are in place and the batteries, antenna and ground have been connected up, you are ready to balance the receiver to prevent aprealing. This is done by finding the proper setting for balancing condenser II. If you are located within a few index of a powerful station. that times in below 40 degrees on the condensers, a simple method of balancing can be used. First tune-in the station as loud as possible. The music or speech probably will be almost lost in a powerful squealing noise. Now turn chesitat T all the way out and plug in your headphones in place. of the impdepender. Adjust condenser II until the music or speech disappears of becomes as weak as possible. Turn rheastat. T on again and you will find that the squeal has desappeared entirely so

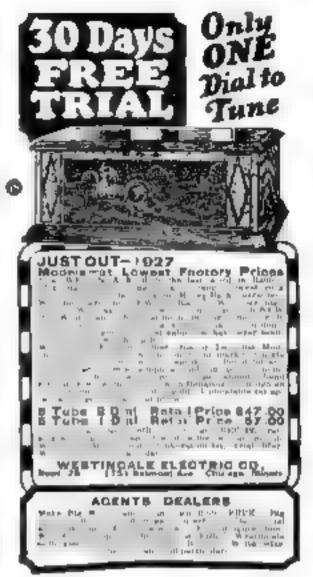


Use the 200A Tube for Extreme Separati Property

Distant stations can be brought to with much greatur volume with the 190A tube to maket M.Z. As the left is shown the grid return wire so it should be for the 201A tube. At the right is the connection for the 200A. Other wiring in left out to make the change clear

that the broadcasting is received with full volume and quality.

With some tubes it may be necessary to leave rheostat T turned down a trifle to prevent aquealing on the shorter wave tengths. The regeneration control knob that turns coil E, when turned back beyand the sero point, after below to eliminate the squeak. (Continued on page 213)





A compared bon manageral resulty applied in plantic form over practical stry blood of first field about \$6 inch lides. Imperial blood does not come force, back of twent to make the inches the strategies. A continuous, and other strategies to gas bergerated, the entire blood to make up to the bright probable, the dust them are probable of paste up.

10 only limit for blocker, Painty Barty Mount, In only Paster, there is been for blocker, but the surface Theorem for the continuous probable in the result of the surface of the first tendency in the artist flower in the result surface. It is the result surface in the result surface in the result surface in the result surface. The foreign that the continuous first the foreign that the surface of pasters in the backers the brighter of pasters.

A Surrection for the Value fragments.

A Success for 15 Years have



Design, Agents, Bet Builders - get nor big 197 Catalog 225 pationary advertised fibes. Lowest prices in America' Largest, most complete stock. Radio's latest developments. It's FREE: sand for your capy now, amenican auto a gable med. Ch., lee. 1402 Medica Mirret, Research City, Me. | 407 MeQue Mireet,

BLANK CARTRIDGE PISTOL



Best Results from Our

Five-Tube Set

The state of the state of

(Continued from page 114)

If you are not pear a broadcasting station, you will have to balance by the trial and error method. Proceed as follows

Turn rhoustat T full on. Set condenser GS to about 30 degrees. Turn condenser GI tall the squeal occurs, which will be in the neighborhood of 25 degrees. Now turn the knob of condenser II a trifle and move the dial on G1 back and forth till the squad is found. Repeat the process until you locate a setting for condenser Hwhere no squeat can be heard when you tune condenser G1.

WITH a good antenna under pormal reception conditions, you will never have to touch the regeneration knob to bring in local and semi-distant stations. It is for use on distant stations or when reception conditions are decidedly unjavorable.

Always content the volume of a station. by turning rheostat Tafter you have tuned condensers GI and G2 exactly right.

Radio is no exception to the cule that wherever there is an effect there must be a cause, and if you fail to get results you can rest assured that there is some good reason why the receiver is not performing properly.

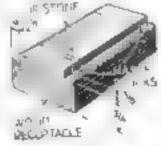
If you run into difficulties, first check and recheek all wiring in the receiver and the battery connections. Make sure that your tubes are good, and if you are still anable to get full volume reception, explain your troubles as clearly as possible in a letter addressed: Radio Editor, Popolar Science Monthly, 250 Fourth Avenue, New York City. There is no charge for information or advice on radio subjects regardless of whether you subscribe to the magazine or purchase your comes at the nows stands.

How a Pattern Maker Keeps His Ollstone Straight

URING many years' experience as a pattern maker, I have noticed that woodworkers wear their oilstones bollow in the middle, as a rule. This fault may he overcome by inclosing the stone be-

tween hardwood end blocks.

Cut a groove in a wooden block to receive the stone and at each end give a piece of z maple 2 in, long zone with the grain running lengthwise. The surface of the block should be



The whole surfece of the stone can be used

flash with the face of the stone. When whetting a chisel or plane bit, you then can use the full length of the stone.

If the surface should show any low spots at times, apply chalk to a straight piece of board about 12 in. long, lay a sheet of No. 22 sandpaper on the chalked surface. turn the stone face down and rub it briskly for a few minutes on the abrasive. -William Lutzenbehoeh.



America's Lowest Cost Power Travel!

ONE-SEVENTH the cost of running a low priced automobile! Half the cost of street car travel! Always ready for a comfortable ride. Convenient - dependable - safe - economical. Easier to ride and control than a bicycle practically self-balancing. Ample power for all traffic and road conditions.

> First cost is also surprisingly low. Complete, with 3-speed transmission and full electric equipment, f. o. b. Milwaukee

HARLEY DAVIDION MOTOR COMPANY Department P. S. Milwaukee, Wa.

EY-DAVIDSON New-Type | Single

Let your dealer explain his convenient Pay As-You-Rule Plan. Send us the compon for full details.

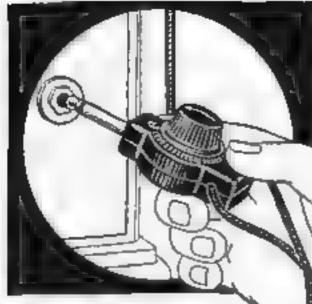


HARLEY-DAVIDSON MOTOR CO. Dept. P.S., Ménuphou, Wh.

□ Insertanced in poor Single; stool catalog and my dealer's rest**. [] interested in your dealer perspention. Iousy secretory open?

Address





Brings Your Set Up To Date

Enjoy the NEW Tone Volume Improvements With Your Present Set

Tone performance in tentured as the squaracti-You can enter by the properties to be a You can enter by the tremendants between guitarit. with your present time very the aricale Weeter-Remove your me species pour replace with New to Plant one you we get that new many pure courses of tous you make

odu plu

There is your atorion on the set, then purfulittle his tions a dispute with the Mache Plag to the easy what of area pet detelor Settled Bea mind plenning recept on as simply luming the point known in the M sto. Plant

for the way you the other that finds I such all turning to the Manua Flag between the set and the apparent of frequencially leading a grow, the ten or over the right base of the right base or asserted in the right base or asserted.

More thank in waits invaluable to give you past the save your tone volume quarted that you have asked a wanted.

Jack Type Cord Type

Contraints Sindy-Plus atmosfered type in for arts with one or more parks. The nord type is for each without packs and has phone much in mcertion between speaker and output binding posts. Also sustable as a resiste control of receiver, and to operate two or more speakers

from your set likber type, \$3.50 at dealers, or maded direct for trial with money refunded with in 10 days U returned not an electory

Centralab Modulator

industrial tenents are ennthal Standard on Bratth or or 15, in by Win his c a trech ri pri 100 rei A III turers of a E BERTHAR



CENTRAL RADIO LABORATORIES

ID Konta Ass., Mikwaukee, Wig.

Materiary is interference resistances for the municipate was of landing blands of sold America Representative-Taland Districtives 151. Combos Brut-tantaire France W Lovine Montreal Great Britain Representative S. S. Rethermet, Lad.,

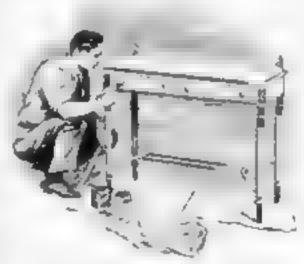
Touches of Color Will Brighten Your Whole House

By BERTON ELLIOT Painting and Decorating Expert

WONT you tell use how to do some of those decorative pieces you are always making?" asked Mrs. Andrews the other evening. "Could I get the same results without too much work?"

Of course you can, Mrs. Andrews," I replied. "Fil tell you how to do the work, and suggest a few color combinations. Your ingenenty will suggest many others. And, of course, you can get any number of good ideas from the beautiful painted things in the shops these days.

Let a see There a that reed chair you have in the living room. It is a wonderful



You Can Do Wonders with Paint

The wayen for color in the bome in foreunate for bonne workers, both usen or women. It is so easy as obtain charming effects with point. The oldest power of furniture yields to the mage of the new roles schemes. Luckily too, queck-drying branking inquery have just been developed, and paint Rores throughout the country now stock surprisingly fine associates of steamls and decalescenson strunders for decorations

nacce of furniture—splendyl design, and I one of the most conductable chairs I ever sat in-but, as you've often said, it doesn't fit in with the rest of the furniture. Now, it's just adapted for a twotone Snish in black and gold.

"This delightful decorative finish is really very easily produced. You samply apply one or two costs of black enamel or black brushing lacquer, as may be necessary to produce a good fanish. With black, on a surface of this kind, at wall not be necessary to use a flat underroater beneath the enamel. And the surface should not be sandpapered either, as its irregular, high-and-low character makes il virtually Continued on page [11a)







entireteen to dadgated with the state of the

the control of the co

AUTOMATIC RUBBER CO. Book 22, COLUMBIA, & C



Shipships Home

Touches of Color

(Continued from page 114)

impossible to sandpaper without cutting through at the edges. After the enamel coat has dried thoroughly-at least for forty-eight hours—a coat of gold bronze should be applied with a brush, and wiped off from the high spots at once with a cloth. This leaves the gold showing in the joints and low spots, while the black ahows on the high spots. The wijning should be good and clean, use clean parts of the cloth as you go along, holding the cloth as flat as possible in the hand.

"HEN you ought to do the hearth L basket over in black, with a stencil design in beight colors, appropriately placed. It will be one of the most stunning pieces you ever saw, and will correspond nicely with the chair, and other furnish-

"And that reminds me-that weker sandwich teny I've seen up on the shelf can be done in the same color scheme and will be striking when used on your test wagon for serving in the hving room."

"Those are splended ideas," saist Mrs. Andrews, chapping her hands in her "I am going to start enthunaum. tomorrow '

"For another thing," I continued, "deared spots of color in any room may be obtained by enameling or lacquering various small objects in bright colors. Pieces of attractive design, but unattractive or manpropriate finish, can often be picked up for a mera trifle. These will look like a 'mishon dollars' when runably finished. In many cases one color will give the desired effect; in others a little trimining in either a bright contribing or a subtly harmonising color will be needed."

AS AN example, I pointed out how candlesticks may be enameled in saucy combinations such as orange and blue, or Chinese red and black, so as to give a colorful touch to the dresser. A tobacco par in Persian orange may be just what is needed in the hying room or sun room. A buttle or jar of artistic form may he made into a beautiful rose holder or flower bowl under the magne touch of bright colored ensinel.

Garment hosders and shoe-trees may be decorated in dainty bives, pinks or lavanders, or in jazzy orange or Chinese red, as may be preferred. The racks may he done in colors to harmonise with wall decoration, and give just the effect desered against the wall or on the back of the door

Porceionlike smoothness, I explained to Mrs. Andrews, may be obtained in finishing many small objects by pouring a little ensuel on the article and turning at round and round until the enumel has run over the entire object. Small objects also can be dipped if there is sufficient enamel on hand to permut doing so. When treated by pouring or dipping, the article should be so placed that any drops of enamel which may form will drop off.

Artistic wall plaques can be made quite easily to har- (Continued on page 116)

A-B&C Light Socket Power



Your battery troubles are ever, at last. How all radio power is in your light socket,

For eacting one unfalling "A" querent, openess either the little Homesharger or the fillite Trickle Charger to your present storage bettery. Absolutely avisation, without bulbs, moving parts, or adjustments, filles Trickle Charger makes a power anti of your bottery—house is always at top offenency. Left parametry on charge, fillite Trickle souverts fight speket current into radio power and storay it in your battery roofly for use at any time—you almost forget about bettery charging forever. For aneoptionally large outs where a high charging parts is ancountry, the filling figurely of passamented. Either model may be used while the set is operating.

SILITE TRICKLE CHARGER

.6 sespere charging rats,

SILITE HOMCHARGER

314-3 amoun charging rate.

Kodel A&B Transi

Rodel A and B Troughters naturally deliver all A, B, and C current direct from the light socket—amouth, sourtant, never-labling power that operates your set always at its greatest officiency. Varily different from and superior to the ordinary power unit, Kodel Transitions some survey only while the set is operating—maintanease sort is less than one-half cent for every hour you use your set. Any radio dealer on show you falls better; Chargers and Lodel Transitions.



MODEL 10 "A" TRANSFRIER

Respiles 2, 4, or 6-volts "A" current direct from the light socker. For some using up to 10 \$42.50

MODEL 10 "B" TRANSIFIER

2214 to 150 volta "B" ourrent; 4 to 10 volts "C" current for ony stee set. Operates power \$42.50

MODEL 61 "8" TRANSIPIER

2214 to 98 votes notations "B" power for arts up to 6 tules

(Bulbe extra)

"Behind the Scenes in a Broadcasting Station" on interesting 34-page bookiet, will be mailed free on request, together with literature describing Silite Chargers and Eadel Transifiers.

500 E. Pearlit, Cincinnati, O. The Kodel Radio Corporation, Owners and Operators of Broadcoating Station WERC

Battery Chargers Power Units

Radio Receivers Loud Speakers

POWER SPECIALISTS SINCE 1912





You ought to have this handy Parks in your shop!

A emponent le moph de montrere di signad le st Take is the great at any original to the state of the sta - 11 the the first was the Parket Write for

The Parks Ball Bearing Machine Co.

15 t7 Knowston St., Cincinnati, Obio Canadian Fectory: 760 Notes Dame Cost. Manteut, Canada





This square Home

Touches of Color

(Continued from page 115)

monize with wall decorations. These are formed by cutting a piece of plywood to a suitable shape, as a frame for some picture or print. The frame is built up in gesso, modeling clay or other composition -every artests' supply store sells statable materials-with scrolls, and hills and dales, of fantastic form. The print is then posted in place, and the frame polychromed in colors to harmoniae with the picture. When completed, the picture is given a very thin coat of white slicher to protect it and permit it to be wiped dust free with a damp cloth.

Striking card-table covers, luncheon sets, aprona, seat covers and hand bags can be nucle from black motation leather or certain types of calcloth and decorated with ateneil designs or borders.

'Another targ." I pointed out, "is that you will find when you get into the work that many up no effects can be produced in various ways as a result of your own ingenials, and after more or less by accalent in 'playing around with some piece of work.

*FOR instance, a most unusual effect may be produced by dropping a, ctr of various custonel redors over a statul of foundation refer with a small brash, or casuel s-mare person, then blowing, to spread the cowes. A attle gold or to smooth powder may be dropped on

'Another munt sometimes employed in doing carolles in to apply 'goba' of color, of rather Hisck ernsistency at the top, and let them run down in ieregular. formation "

"I can see where I am going to have lots of fun 'said Mrs. Andrews,

" Vish now " I conteried, "a word about the use of steneds will not be amiss. The decoration of enamered, lacquered, painted, varnished or stanged furniture by means of stencils is the finishing touch that adds charm to many a piece. It may be the making of an otherwise very ordinary prece of furniture.

"A dressing table, a wall panel, a rabinel, or a chair back may demand such an ornament. Often this ornament may he so unobtrusive as to escape casual notice, yet the piece would appear have without it. Stereis may now be obtained in most first-class panet stores, together with suggested color combinations for the various designs.

"The material used may either be enamel, prepared stencil colors, colors in oil, or flat wall paint. The enamel, of course, gives a full enamel gloss to the stenciled design, whereas the other maternals sudicated dry with a relatively flat or dall finish.

"Small stened brushes may be obtained for use on furniture and small articles, The stencil should be held perfectly flat and the color applied by pouncing the brush. Care should be taken not to allow the color to run under. The back of the stencil should always be wiped off with a cloth monstened with gasoline before it is re-applied to the surface,"

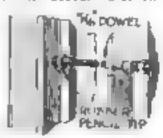
The complete of the

Improvised. Curtain Rod

IN AN CONCERNIev. a mah curtam rod may be constructed of a 34-in.

dowel stick, which can be obtained in almost any hardware store, and two soft rubber pencil eraser tips, such as may be purchased in a ten-cent store. Cut the

dowels about 1/2 in. shorter than the distance between the window casing, put on the tips, and aqueese the rud in place. No damage is done to the woodwork. -RICHARD C TARR.



Made Press a down and two eresers

Remedy for Sagging Doors

INTERIOR doors in old houses, when hung on brass or bronge butls,

sumetimes and because the hinges have become badly worn through constant friction. In some cases this can be remosted by removing the pins, filing the hinge, if necessary, and inserting small



Adjusting a worn bings with weahers

train mashers as shown. I have made washers for this purpose by betsling and flattening occinary telegraph wire. This expedient is especially useful when it is desired to preserve old and unique hinges of a design that could

ant he duplicated unless made to order -W J. E.

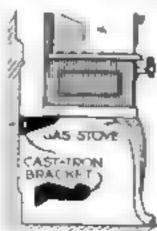
Gas Range

BY ELIMINATING A Two-Legged the two rest legs of a gas range and supporting the

back of the stove on brackets from the actches wast, the task of cleaning the latchen floor is made easier for the housewafe. She has to clean around only two unitend of four feet.

It is a appropre matter in most cases to substitute brackets for the rear legs. A

bracket to fit on the stove where the legs are attached can be winttied from a piece of soft wood taken from an old box. After it has been sand papered amouth and given a coat of shellac, it will serve as a pattern for having two iron castings made at a foundry. In some cases a pair of patterns,



from brackets replace two of the store legs

one right and the other left, will be required to make a good job.

It is necessary, of course, that the heavy acrews which fasten the brackets to the wall should be driven firmly into the wall study or sheathing,--C. D. P.

Andrig Suiting Suiter are fully illustrated—easy to read and understand. Each set is a Good Train from for the apprentice—and a find Believes for journeyman and master. Use coupon below for less examination,

Audels Carpenters and Builders Guides—4 vols. \$63 less to an emption Illustrated, for Carpenters, Builders, Jonneis, Building Mechanics, 1999 ungest

2700 diagrams; finishing pecked plan, Shirt out matruct was, non methods. Jess, salts ma, pune to the east or offens a course for the notifenter. A pract of daily the better and that it the master worker. A linguist that the former and that or Work and Bester has T per thin aid for yourself stopply fill to and end the PREE Coll Park to the majory paring suggestance A Leanne Hand to

INSIDE TRADE INFORMATION ON:

Youk of The Frade How to Use The Steel Sensors Saw Filling Johnson How to Make Persotters Corporters and Buildors Arithmetic How to Shad and Grow Place Specifications that to Figure John Noose and Boof Francing How to Lay Out Work Faundantium Doors and Windows Stairs Millowerk How to Paint and leandrode of attemports and septembers all easy to read and understand.

"Andres Carpensers and Bur dees Guides dee not what many from some fronts than he would get a chord to for him property with the Re would get a chord to for him property work. I. M. Manualing, Lankgart, M. Y. Personal Burk

Audels Plumbers and Steamfitters Guides—4 vols. St

new set not not a practical Haustrates. Leterance Library and Music surper for Master ambers. Journey man and Apprentice of motores and I to and its ore bleet Mital Winhelm. Plansberg, Joseph p man and to advance. Master Builds at F a second little of T ale students. Mile capacity 1842 described when the principles, advances and short use of he rimenbing and Heating trade. Continue instructions on here in higher are estimated to be I as FREE coupon below to examine, with

out obligation, this valuable work

INSIDETRADE INFORMATION ON:

Playmbers Code Playmers Materials and Yeals of The Trade-Load Work Water Supply Drainings Raugh North How he make Tooks Non to Figure John Pipe Fifting and Scouting Starting Variabition Refrigeration day Stoom Shoot Metal Work Sentining Brazing Stooms and burndrade of eline subjects counting the playment trade Each point charty populated in heat and pictures that you can be published the

"Andrie Guides are practical, sure to understand, and can be relied upon. They seem the stille field in

Audels Masons and Builders Guides—4 vols. 56 A new minister all interested trade tolerence is many for the Lie with Common Workers Plants at The Vertices and Monte to the distance of the Common of 1100 pages) 2007

Magnemet Costolog posited Size. Vertical Indian Ambiguit

or the second of g arther higher was presented a ear

INSIDE TRADE INFORMATION ON:

Brech Work Wen in in Arthur Stateme Conde and Peniger Betch Foundations Assess Stone to bet the Man in Figure Inks Consests Work Stone Stone House in Clare Factors Bulletiness Stone Statemen Stone For a Stone Constitute in med hundreds of other subjects out State Constitute in med hundreds of other subjects out State Constitute in State Constit of A bonnet Cortex big

Audels Handy Book of Electricity-1 vol.



Austela Randa Rook of Praracas Factores, Manheated, to a Randa cand be a more in our take, and be but regard to de for each or hand to me or a physical set a first to be a state or the 1. cr. b.b. 2 Sarke a life-1850 pagest 2000 diagrams. A

INSIDE TRADE INFORMATION:

Wring Blagrarm Colculations Machine Biothes Main-tenants and Repair Sudio Armstore Winding Power Wring Sturage Satterns A. C. Weiters and Wiring B. C. Meters and Wiring Telephone Yolograph Ignitium Generators with Bady Between India 4 CC 2011

To Earn More-Learn More

Your Big Opportunity for Advanfying It Insures you against users of playerson Learn all about your trade ill by may combing of those Builders Caridon.

MUN GUARANTER

Examine any bank numbers by an estimat that per if you like it, keep it. If not, swell it both. Pay we only if you are artislied, the charge if you are not.

THEO, AUDEL & CO. 66 W. 23rd St., NEW YORK, N. Y.



....+

THEO. AUDEL & CO. On W 23cd SV, NEW YORK CITY Deare that for for free committees the broken the hard is selected from the first of account agrees that I am

dars on tack or A truth ger and mad \$1 mouthly one achief until Have paid he purchase price, 4 CARPENTERS 7 4 PLUMBERS

1	4	COLDER 36	
	1	4 MASONS	
	1	GUIDES IN	
-	_		

HANDY BOOK M

NAME ADDRESS TOCCUPATION EMPLOYED BY

II TJ4





tone reality need not be expensive

You don't need an expensive set to get faithful reproduction. Resistance coupling gives even amplification of all tones. And it has the added advantage of costing little and consuming less "B" battery current.

Micadon 640 A is the Dubilier resistance coupling unit. It is a fixed condenser of the famous Mica. don type, designed and patented by Dubilier to provide unvarying capacity with the lowest dielectric loss—so essential for the true reproduction of sound.

Used with the silent Dubilier Metaleak, Micadon 640 A will give you the foundation for an amplifier unit with all the tone quality found in the best radio sets.

> Send. 10: for our bunklet, showing fourteen ways to improve your ort with simple applications of fined сообствень.



4377 Brutts Blud., New York, N. Y.

Polishing Waxed Floors

Polishing waxed hardwood floors m no easy task unless on electric

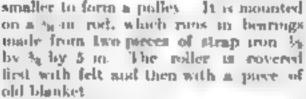
polisher is available. In many localities these can be rented, but in my case it was necessary to improve a polisher.

Thus was accomplished by mounting a A-horsepower electric motor on a platform cut from a beavy board 12 m. square. This is shaped so as to be only 8 in. wide in the back, where it is supported on two

> hardwood wheels. These are mounted on a 1/4-in. steel axie, which runs right through the heard. Ordemany earpet sweeper wheels would serve for this.

The front end of the

platform is on a toller 11 in. long turned to a diameter of 2 a m from a parce of 4 by 4 m pine. One end is turned down



A word utility motor oper-

atre the homemade polisher

The motor is set at an angle so as to allow the polisher to go as near the wall as possible. The belt is so arranged that the roller runs clockwise. One trip back and forth over the same spot is generally enough to produce a high polish.

Incidentally, the motor used with this polisher also serves to run the lattic upon which the wheels and roller were turned. and, in addition, operator a mostl churn. -A. J SWEEKEY

Bathroom Water Heater

LN & MINGLE family house where the bedrooms and the bathroom are on

the second floor, it has been found a convemence to have a place for heating a little water without having to go downstairs to the kitchen, especially at night. A gas pipe was run up through

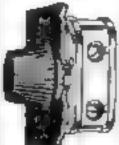
the floor, as sliustrated, and fitted with a short, stationary bracket and a Bunsen burner mich as can be obtained in tencent stores. It was lucated about 8 in. to one sale and a little below the top of the lavatory.

The burner serves for heating water for singing and for a hot water bottle, when neccasary. If the



A convenient way to heat shaving water

room is chilly, it can be turned on to raise the temperature a little. In times of illness this little heater is worth its weight in gold. -C. D. Patrisson.



Provides complete poweless filement control for all radio tubes without change of connoctions. Metal parts are mickel pleted. One hole mounting. Self contained switch opens bartery circuit When destred.

llen-Bindley Co.

Electric Controlling Apparetus 193 Greenfield Avenue Milwanker, Wh.



THE MOSTA'S CO., Beat, TST, LOS. 18th Mosel, Pidledge



IEARN TENOR BANJO

Chicken Tonor Genin to 1906, 2346 18ks at theopie pt.

FOR FREE BANJO OFFER NOW

You and This Machine Can Earn \$300 Monthly

Charge Harriston to by unual time at a cost of mall space rethere at 5 case. Putted space required. First really the in retmen on puter and he special
servicies regulared. The special
servicies regulared by payment a
to they of the Trial. Write
today to Hohart Breeknes, Baze
Fit Truy Chico.



FREE - OUR SA-PAGE CATA-LOGUE. FILLED WITH RADIO BARGAINS WRITE TODAY I RANDOLPH RADIO CORP. 140 M. UNION AV BEDE: 3 - CHICAGO, ILL.

DIESEL ENGINES

Marine and Stationary By ERSIGN DAVID L. JONES, U. S. Navy



The most complete, thoroughly a action and up to-date treatise un tor Di sel Engine ever published. It explains their on nat runtion troubles, remedica, operation and adjustments, proceed trials may bets and the sig-mentary thermosphysics of all types of the Direct I name. The book is fully illustrated First drawings of working parts and detail engravings. éOtr pages.

Price, \$5.00 Popular Science Monthly 250 Fearth Ass., New York, N. Y.

GETTING AHEAD?

Read the advertisements on Pages 136 to 167 this issue if you want to get shead!



THE man who doesn't need a boss is worth more than one who does.

Chip clearance is important if you are to get the best results from a milling cutter.

Before inserting a taper shank or socket in a spindle hole, be sure that the hole is free from dirt or chips.

Loafing on the job is Just a good way of cheating yourself.

If a milling cutter does not run fairly true, or cuts on one or two teeth, as frequently is the case, investigate the cause and correct the trouble at once.

The cutter may not be ground true. there may be dirt in the spindle hole, or the arbor may be bent.

A mechanic's knowledge of the tools and materials he uses is an important factor in his success.

There is generally a way out of every difficulty in which you may become involved; use your wits and find a equation.

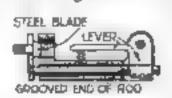
Ambition is only another name for interest in what you are doing, plus hard work.

The surface opend of a grinding wheel is reduced as the wheel wears down

Don't forget that there is a speed limit for grinding wheels that never should be exceeded.

A Fixture for Holding Small Screwa by the Head

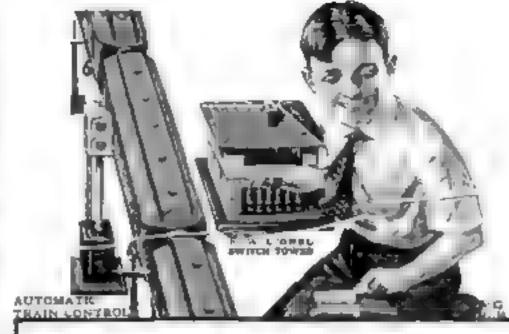
MACHINIST who had pushed his A thumb into a grinding wheel while shortening a small screw by granding the



A guide-acting clamp for holding the screws

end off, put his wits to work, and when the next lot of accews campe along be had the little holder illustrated made to save his fingers from damage.

All parts of the holder are made of steel. The lever is arranged so that an ordinary hand grip will hold the screw firmly in place. The lever goes through the body of the holder and its smaller end engages a groove filed in the rod.—F N C.



As if by Magic!

-you can run your "Lionet Standard" Train at various speeds, stop it and reverse it by manipulating a small lever placed at any distance from the track. As if by magic-your Lionel Automatic Train Control will start and reverse your Lionel Train without being touched by hand, and as if by magic-you can switch your "Lionel Standard" Train from

track to track with the new Lionel Electric Switches by manipulating another small lever placed at any distance from the track ... Lionel trains and equipment have been "Standard of the World" since 1900. And now, after years of experiment, Lionel engineers have accomplished the greatest achievement in the history of model railroading by creating

The New Lionel 100% Electrically Controlled Railroad

for "Lionel Standard" track.

Lionel makes the most complete and perfect line of model Passenger and Freight trains in the world, -both electrically-controlled and hand-controlled for "Lionel Standard" Track, and hand-controlled for "O-Gauge" Track, Lionel Trains are real in everything except size;

every piece beautiful in dealgn, perfect in construction, and fully guaranteed. They contain hundreds of improvements and refinements not found in other lines. Yet Lionel Trains are the lowest in price consistent with supreme quality. You can buy a Lional "O-Gauge" Train for as low as \$5.75!



THE LIONEL CORPORATION, Dept. \26

15-17-19 East 26th Street - NEW YORK, N Y-



ELECTRICAL **EXPERTS** IN DEMAND

Good positions await trained men. Spinrios of \$12 to \$30 a day are paid many experts in this field.

THE Electrical field preds men. It needs them hadly. Hardly a month or a year passes but what some new use for electrickly is discovered. Each new use means new positions-priter partitent-tor men who have trained themselves at experts in this wonderfully fascinating work.

Why don't you mudy electricity and prepare for a good position at a good salary?

You can do it sight at home in spare time. through the International Correspondence Schools. Home-study courses endorsed by Edison and Steinmetz. Successful students everywhere.

Mork and mail the soupen today for Free Becklet

---- TEAR OUT HERE -----INTERNATIONAL CORRESPONDENCE SCHOOLS Bur 7511 E. Berneten, Ponne.

Oldest and forpest surrespondence achools in the morld Engleit, weitheit ubliget in the how I care qualify for the poor on, or in the subject, before which I work E.

England, we place to higher to the pure off, or not be subject to the pure of the pure of

no. Low double for L. before milet I buch I. CHEMICAL BRUINER I. Procusery hat Family have been strong to the party of the

THIS 68 PAGE RADIO CATALOG

Partie Specialty Co., 96-P Part Place, May York, M.Y.

Secrets of Using Cut-Off Tools

By H. L. WHEELER

"UTTING off steel hars in the lathe is, most. Cutting-off tools give more trouble than any other type of tool. This is especially true when the work is large or rt is necessary to make a cut pome distance from the chuck.

A knowledge of the causes of trouble will help to overcome it, and some ruggestsons will be made that should lemen the annoyance of cutting off work.

Everyone known that the spindle bearings and the cross slide gibs should be tight for any kind of accurate work. Thus is more than true for cutting off Of course, the machine may be too light for the job; that cannot be beloed, but it does make all the more necessary the utmost attention to every detail

The first indication that trouble is in store is the clustering of the tool. This

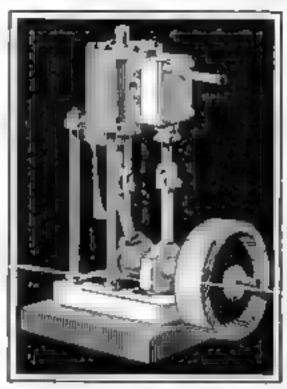


means that something is loose, or that something is "giving "under the pressure of the cut. Here is the time to check the spindle boxes and the cross slide; to see if the tool projects too far; to make sure it is tight in the tool post (a strip of emery cloth under the tool sometimes helps). and finally, if the tailstock is being used, to see that the spindle does not extend farther than is absolutely necessary.

If these precautions are not taken, and sometimes if they are, in about a second and a half something may happen. The machinist will see his tool begin to smoke more than it has been doing, then there is a group of the gears or a shrick of the belt, and the tool breaks.

The tool is confined by the walls of the cut so that the heat generated cannot get away. The point of the tool burns, refusing to cut; the chips become wedged, and the tool is broken.

A little consideration to the form of the tool must be given. The time to give this attention is before the cut as commenced but any time before the tool breaks is a good time. It is obvious that there should be some clearance on the sides. Yet, there are (Continued on page 121,



GET A HOBBY MAKE MODELS Start a Home Workshop

"World Making" by R F Yetes describes the name cart in all made ghe-rapping a come ognation has a street broader, a maintain per-lations the male ground of Housey chapter at according to the chapter of and manager of the

It will hear you to become a be try suchance it will hear you to be hard a dde by wellend-broug lastes work, tempering, drubing

such that is the work, topopering, directing such as making the "little to a tracking the "little to a tracking topopering to the such and makes when it is may never a greatest that the such tracking the such topopering to the such tracking topopering to the such tracking the such tracking the such tracking the such tracking that the such tracking the such tracking that the such tracking the such tracking that the such tracking that

POPULAR SCIENCE MONTHLY 200 FOURTH AVENUE, NEW YORK



TWENTIETH CENTURY

Recipes, Formulas and Processes

This book of 800 pages is the most complete Stack in Brespon ever published giving throughts of restore for the manufacture of valuable actions for averyday day. Butte, Helps, Fractical Ideas and Breset, Processis Helps, Fractical Ideas and Breert Provincest covering every branch of the useful arts are

10.000 Practical Formulas—The Best Way to Make Everything

A book to which you may turb with confidence that you will find what you are kendlag for A natural for formation upon that in every respect. Can take an immense number of formulae that exery one ought to have one are not found in the other

Price, \$4.00

Popular Science Montaly

Beiter Shop Methods

Cutting-Off Tools

(Cuntraum) from jespe 189)

men who will start to cut off work with a tool having no clearance, or worse, one that is narrow at the point. This clearance should not be too much, however, or it will weaken the blade and may cause scoring because fine chips will get lodged in the clearance space. If the end of the tool is rounded off on about a 1 an. radius, as in the diustration, the chips will not be flat, but will be curved in section, and will be narrower than the tool point which produced them. Therefore they will go out of the cut without baiding.

Then there is to be considered the amount of power put into the work. Many men will always "back gear" the lathe for cotting off, regardless of the size. of the work. For plant turning a piece of mininar aize they would not think of running at such a slow speed, nor do they believe that the amount of power the back gears will give is peeded for the small chips the cutting-off tool takes, Let they throw in the back genrs, taking away the margin of safety of a slipping best. Ur less the work is so large that an open belt speed will be too fast try to avoid using the back gears for cutting off work:

For large work, it will be found demeable to make the cut about bullway through and then increase the width of the cut so that there will be more room for the chips to get away.

It has been said, and everyone known. that a lot of heat is generated by a cutting-off tool. This best cannot easily get away of its own accord To cut freely, the corners of the cutting tool must retain their sharpness, which they will not do if they get hot.

One remedy is slowing down the machine but, as has been shown, this is not to be desired. The other method in to flood the tool with oil, cutting compound or water to take away the heat as fast as it is eccated.

Rubber Tipped Pencil Serves As a Center Indicator



in the absence of a regular indicator a commen lend pencil may be used in locating work

F THERE is no dial or other type of indicator at hand, a pencil may be used at illustrated for closer work than it is possible to do with the unawled eye. The point of the pencil as inserted in the punch mark and the rubber tip prevents the pencil from revolving. The motion of the pencil may be seen clearly against a white wall or sheet of paper beld behind the machine. A. A. B.



THE Aristocrat Vernier Port Dial is as time looking, as fine tuning as a dial can be. Men and machinery cannot build a finer deal. Yet, despite its incomparable quality and superior advantages, the Arestocrat costs no more than ordinary vernier deals

Vernier ratio is 14 to 1—fine enough to bring in countless stations that you've never heard before. All mechanism and shaft ends are concealed No gears, chains or ougs to backlash, wear out or get out of order. Easily installed-in but a few minutes. The famous Kurz-Kasch Split Bushing hes all condenser shafts-aligns rite, holds rate!

To acquaint you with this new superior dial we are making a special limited FREE Offer. With every set of three Arrestrat Vernier Port Dials. your dealer will give you an up-todate Log Book of 48 pages (worth St) It is bound in beautiful, twotoned MoCoTan Leather, embossed. Lists every station in the country using power of 150 watts or more All the important foreign stations listed. Indexed by wave lengths, call letters and location. You must see this Log Book-only then can you appreciate how valuable it is

Remember, the Arritograt Vernier Port Dial is supplied in three finishes -black with whose markings and mahogany or walnut with gold markings-at the same low price-St. It is sold at all the better dealers. If yours cannot supply you, tell us about it

THE KURZ-KASCH COMPANY, DAYTON, OHIO

Moulders of Plastics

Overes: New York, Chicago, San Francisco, Los Angeles, Portland, Spokane, Denver, Toconto-





Sit in with your favorite orchestra

Wonderful teacher—the phonograph! First it taught us to love good music. Now it is teaching us to play. You can acquire a master style by studying your favorite records with your

BUESCHER True Tone Saxophone

You have a natural desire to personally produce music. Don't starve that desire. Develop it. We recommend starting with a Bucscher Saxophone because it is the easiest of all instruments to learn to play and its music is the most beautiful.

You Can Teach Yourself

If you can whistle a tune, if you can best time, you can learn to play the Buescher Sexuphone. Easily? You can teach yourself, at home, in a few evenings. Three simple become given on request with each name Basephine start you. You learn scales in an house and start playing cones in a week. Your progress will saturable and delight you and surprise your friends.

Try Before Buying. Easy Terms Tehn home with you any Buescher instrument, Trambone, Burner, Trampet, Samphone for the days' trial. Test it. See what you can do with it. If you like it, pay a little each mooth. Play as you Pay Satisfaction guaranteed. Send for beautiful free caulog of any instrument and devans of trial and payment plans. No obligation. Do this today.

BUESCHER BAND INSTRUMENT CO. Everything is Band and Orchestra factorments Ellibert, Indiana 27.31 Busscher Block



The Story of the **SAXOPHONE**

Gives complete history and dary to leven to pluy. In it was will find the first lesson chart. You must have then fine buch.

Clip the Coupon NOW!

SUESCHIR HAND INSTRICTION TO 1723 Describe Block, Elither, Indiana,
Continue Without obligating no in any way please send me your feed Merature. Lan interested in the inatrument checked below Basephone Covert Transpot Transpos Transpos

Martino say other Name

Address

Bener Thop Method.

Error-Proof Fixture for Difficult Keyway Job

By O. S. MARSHALL

IN CERTAIN key-alotting operations on a fishtail miller, a holding fixture of the type illustrated has proved an aid in reducing the chances of error. The large illustration shows the arrangement a flanged sleeve in position on a holding arbor. One member of the holding arbor has been removed—the retaining cultar and her exposed for study purposes on the machine platen. The smaller illustration shows the holding arbor in detail.

The regular machine angle-vise, having a PO-deg, hardened and ground face, is used for grapping the special mandrel. This mandrel has a square shank to be gripped in the vise. A 34-m. standard key





How the fisture to used up a milling machine (upper view) and the arbor in detail (lower)

is set in the opposite end of the mandrel to locate the large collar angularly.

The member to be milled in this instance is to have two 14-m. keyways on opposite sides, S in. in length, they must be accurately located with reference to the two holes in the flanged end. Note at the upper side and near one of the two holes mentioned, a half hole in the outer rim of the projecting flunge. Note use a locating pin in the retaining collar. When this color is placed on the end of the mandrel and located from the key, the blank is rotated uptil the half-hole engages the locating pin of the retaining coolar. It is then in correct position for unling the keyways.

The mandrel and the work cannot be assembled wrong, for the mandrel must be caught in the machine vise properly before it can be of use; the retaining collar cannot be put on except by engaging the by me key, and the work and retaining collar cannot come together unless the locating pin engages the half-bole in the flange.

Small removable bushings, which are retained by screws, adapt the mandrel for holding flanges of another size.

To room the cubic inches in a ball multiply the cube of the decemeter by .5236.



Boy, Here's *Real* Music!

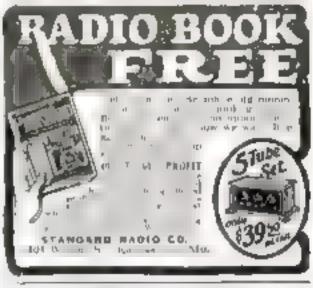
Where is there a red-blooded boy or girl who doesn't like music and crave mudeal expression? And where is there a musical instrument that combines the natural appeal and national popularity of the harmonica?

The Hohner Harmonica is endorsed by amateur and professional musicians as the logical instrument for stimulating interest in good music among people of every ago. It teaches accuracy, sythm and expression, the basis of musical education.

With the aid of the Free Instruction Book, you can quickly learn to play a Hohner Harmonica, If your dealer can-not supply you write M. Hohner, Inc., Dept. 182 114 E. 16th St., New York.

When you wish the Sengui-Contennial Expedition at Philodolphia be ours and on the exhibit of







LINDSTROM & COMPANY W Lake BL, Topt 13-66, CHicago, B.

Free Book

SPORT BODIES for FORDS AL FACTORY PRICES!



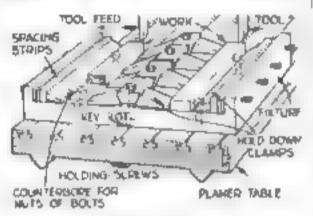
Middel \$39.50 Write for Booklet

A 10 Sharing Other Musike SPORT FACTORIES, Aurora, Illinois

Betwee Shop Metkola

Fixture Aids in Planing Flat Pieces Quickly

IN MANY shops much of the planer work involves the planing of flat parallel pieces of various sizes and lengths. In large shops one planer may be given over to this work aione. The fixture illustrated was built in such a shop and kept on a planer as part of its equipment. The fixture is arranged so that the pieces to be planed are held tightly to the bed of the casting, which



Because of the fixture's rigid construction, work can be planed with speed and servency

mentes that the work will be of equal the kness throughout.

The body of the fixture is made of cast tron, and the accessories of steel, pack-hardened. The accessories on the steels are used not for clamping, but mere'y to se the spacing strips in so that the wedge hold-down clamps in the center can function properly. A pad rates the inner end of the clamps so that they have a downward thrust as well as a sale thrust due to the bevel, which should be about

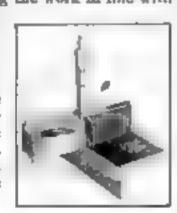
A key alot in the bottom aligns the fixture. If it is taken off the planer, or used on another machine, a light cut is taken off the work-holding surface.

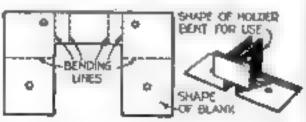
Micrometer Stand for Keeping Thin Pieces in Alignment

Till pieces, strip stock, and the Like are hard to measure accurately with a micrometer, as there is ordinarily no way of keeping the work in line with

the spindle of the micrometer. The photographic illustration shows a sheet metal stand, the flat face of which is in line with the spindle and provides a surface against which work can be placed.—A.K.

twenty degrees.





How the stand is used in measuring a thin ring and drawings to show the construction



No. R-403 Tube Reactivator.

For large and small tables, ununding as I generally and No. a. year to us used as interest depends after the parameter. The parameter is a property of a resolution of a resolution of the parameter and a series what depicts the products contribute for their represent.

Access for small UK and UK toles

Plan

Br. D



No. R-225 Midget Reactivator.

Paste paragalants for an-recurs who want a few plants to further makes and factor of the plants of t

STERLING
RADIO
CARETAKERS
and
INSPECTORS
include

Borney Chargers, Trockle Chargers & Pares Ulinta, Tabe Beastreamen, Tube T seems Charge Indocument, Packet Meters, Panel Meters, etc. GIVE two people the same kind of set, proper aerials and equivalent geographical conditions, and one set owner will get good results continuously, and the other poor. Why?

Chiefly because the successful one pays proper attention to the upkeep of tubes and hatteries. There is no denying that peppy tubes make a world of difference to reception.

This does not mean buying new tubes either. It means simply new life to old tubes thru using the Sterling Tube Reactivator. It means good radio and permanent tube economy.

Sterling Tube Reactivators

Ash for our men 32-page book on the care and upkerp of radio.

If your dealer count accommodate you write up direct

THE STERLING MANUFACTURING CO. CLEVELAND, OHIO



ASK . . ANY . . RADIO . . ENGINEER



This is the new Burgess Radio "A" Battery

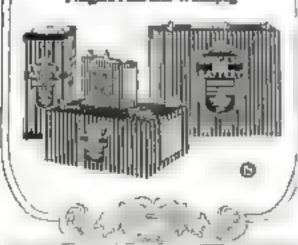
A SPECIALLY designed "A" battery for radio service. There is nothing like it in its field.

Proportioned to permit case of handling and convenience of cabinet assembly and atorage, you may expect this new Burgess creation to give you the length of service and dependability under all conditions for which all products of Burgess are noted.

If you are using the ordinary type of No. 6 "A" battery, we suggest that you learn for yourself from the Burgess Radio "A" the measure of service you have a right to expect.

Ask Any Radio Engineer
BURGESS BATTERY COMPANY
GENERAL SALES OFFICE: CHICAGO

Canadian Factores and Offices: Nugura Falls and Wassepag



BURGESS RADIO BATTERIES

Detter Thop Methods

Using a Small Shaper To Do a Large Job

By ALBERT A. BAILLEY
Focational Instructor, Cohors, N. Y.

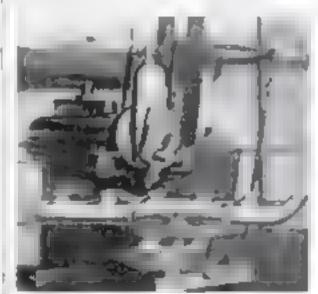


The problem was an fasish connecting lugs on m exhaust manufold with a small shaper

HOW a 32-m, job may be accomplished on a 16-m, shaper is shown in the accompanying illustrations. The method was used in this case for shaping the connecting lugs on an exhaust manifold.

In order to insure perfect alignment, it was necessary to finish the job in one setting auxi without moving the tool. The length of the ensing was 34 m, and the expectly of the shaper 16 m.

Three of the lugs were planed with the vise turned about 45 deg, to the right. Hy swinging the vise about the same amount to the left, or to about 90 deg, from the first setting, it was possible to reach the other three lugs without difficulty.



After three of the Jugs were planed as in the upper illustration, the vine was turned so deg, and the remaining Jugs were fitnished

Grinding Very Small Radii

On AN occasion when a very small radius had to be ground with a standard surface grunder, the writer had another pair of tight and loose pulleys put on the countershaft and the largest pulley on the line shaft that would run clear. An extra shifter was arranged for this belt. This shifter was made with a removable section, so no one would accidentally start the machine at the higher speed white a large granting wheel was on the spindle.—H. J. C.



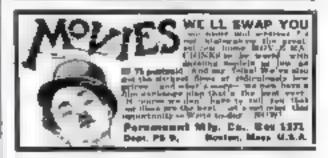


SQUAB BOOK FREE









DEAFNESS IS MISERY GOOD HEARING A JOY



Millions of people beam that, but Malarades of paratons with delective hearing and iteral November apass enjoying conversation, go to Theatre and Church became they are Lecture Instable Andseptic Ear Drams, which are Tone Migsphines for og a she flar encisely our of eight. No wires, the hasterness, no head passe. They are Unicen Comforts and nexpensive. Write for bounters and swore starspaces of the inventor who was hinself deal.

A. O. EBONARD, Lat., Subs 144, 70 5th Are., New York

Read Interesting article on Page 4. "How \$100 a Month, Invested Properly, Can Make You Independent."

BUCHSTEIN'S FIBRE LIMB



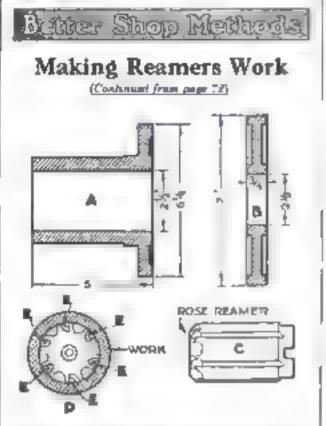


Fig. 3. Two sudically different types of renesing jobs (A-B), and views of a ross reassar

of material. For cast from or malleable iron you can use a reamer that is really dull and yet get quite a good result. For brass or steel you need a sharp tool in order to get a smooth hole. Also, for the finest work on hard brain or brouse and also for steel, you need a lubricant like lard oil

"A long hole can be respired better with a renmer tapered at the end. For a short hole through a piece of this cast from steel or brass, you need a rose type of reamer. Look at this sketch (Fig. 8). At A is a cost-iron flange having a two-and-a-half inch hole, five inches long. You would ream this kind of hole in this kind of material with the nedmary type of fluted reamer, after borneg the hole to a use from fifteen to twenty thousandths below the funded size

"For a job like this at B (Fig. 3). which is a thin becaze cast ug, you would want a rose type reamer like that at C By the way, do you know the difference in the cutting action between a fluted reamer and a rose reasper?

"I know they look different and a rose reamer is supposed to give more seenrate work, isn't it?" responded Harvey

"Wel , look here," and Grames, "Here's a sectional view of a piece of work (D),

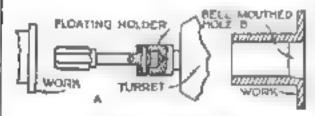


Fig. 4. In surrer-lathe work a resoner requiter a monting nower and, it besty point be supported by hand as it enters the hale or it may cut a bell-mouthed hole at first

with an end view of a rose reamer in position. Compare this with B in the previous sketch (Fig. 2) You see there are no cutting edges along the length of the reamer; just thip grooves at E to allow chips to pass out, or for labricant. The outside of this kind of reamer is ground cylindrical so it cannot cut or entarge the hole. For this reason it is timeful on a job like (Continued on page 146)



Your radio set gets all the sound waves now. Does your speaker reproduce all—or only part of them?

Cone speakers have large conical parchment diaphragma. Hitherto, these diaphragma have been Concentric, with the stylus [actuating unit] at the center.

Now the first scientific cone—the new Saal Cone is Ec-centric. The center-literally "off center," This construction is based on known musical laws. Note the diagram—the Saal in comparison with that most melodious instrument—the harp. In the harp [as in the piano] long strings produce deep low vibrations. High notes require small space, short strings, Similarly in sound reproduction high notes require less space for expression than deep low tones.

These exact proportions of vibrating area, fixed by scientific principles, are now provided by the Saal Ec-centric Cone. Balanced reproduction without un-Decemary size.

Performance? All the music-much of which you are missing. Operates perfectly with or without power amplifier. Tone unsurpassed by any speaker in the world. No drum or barrel effect. And at a price never before offered in a quality speaker.

A highly decorative instrument with scrollwork medalison and border design in gold.

Investigate this principle—hear it. Write for descriptive literature.

H. G. SAAL COMPANY 1800 Montrose Avenue - Chicago, Illinois



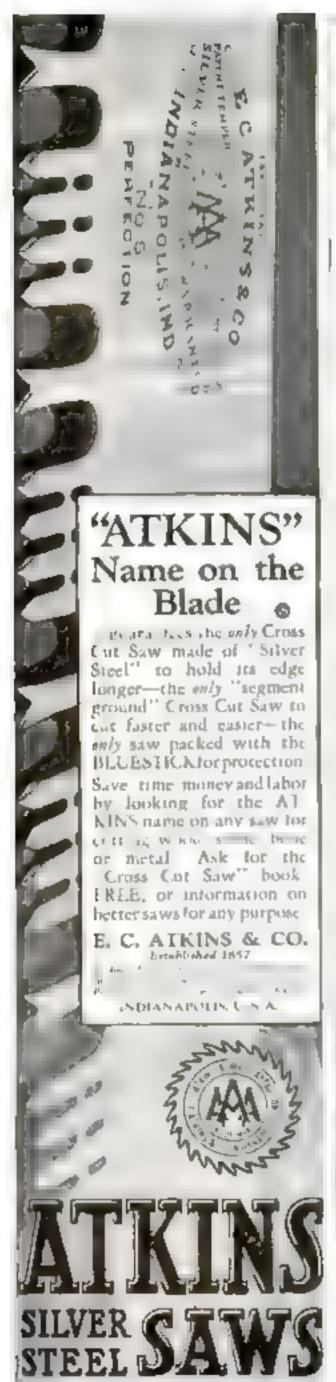
WORLD FAMOUS MAKERS OF HORNS - CONES - PEDESTALS



Saul Ec-centric Cone Hought 22 maho

Juntor Come Madel Height \$15 16 tuches

Slightly more Wast of Rockson



Making Reamers Work

Companyed from page 12s,

that at B (Fig. 3). A fluted reamer might drug m the hole and enlarge it, but a rose reamer could not do this. Do you get the idea, Harvey?"

"Oh, yes. I understand it thoroughly

now, Mr Grimes."

Here a another point in reaming. continued the engineer. "It makes a good deal of difference how you hold a reamer when you are finishing a hole. If you are reaming on a drilling machine, the work abould be free to float, so that the reamer will follow the drilled hole, or else (if the work is in a pig) the reamer should be piloted in a bushing. If you are doing a job in a turret lathe, the reamer abould be held in a floating holder as at A in this diagram (Fig. 4). That allows the reamer to follow the hole and cut evenly. With a large and heavy reamer, you should support it by hand and stondy it as it enters the hole to prevent getting a hell-mouth hole as at B. This might be caused by the weight of the reamer, if pot supported.

" ANOTHER point of importance to remember is this Suppose you have a lot of work like that at A (Fig. 8). If you use just a horing har and reamer you will probably find a variation of from one to two thousandtha in the size of your reamed hotes. This is because the reamer has different amounts of stock to remove. If you use a roughing and finishing boring bar, you will usually avoid this trouble.

"Yes, I know that, Mr. Gromes, from my own experience," and Harvey, "but even with two boring cuts I have sometimes had trouble. How do you account

for that?"

"Well, it may have been because you didn't allow enough stock for the reamer to cut. With only a small ailowancesay eight or ten thousaniths, the reamer has no little to take hold of that it sometimes pushes the metal away and doesn't ent it properly. I have known eases of thus kind when a reamer removing ten thousandths of the stock did not give an accurate hole, yet, by giving it twenty thousandths of stock to remove, the holes were accurate and undorm in size. These are good things to put down in your nutebook."

"T'M PUTTING them all down, Mr. A Grames," Harvey assured him, "but now you haven't told me anything about tapered boles and taper reamers. I have had trouble several times with taper jobs. Can't you give me some dope on these, too?"

"I guess we shall have to wart until the next time you come up, Harvey Taper reamers are funny though-we'd better take one problem at a time.

TN HIS next article Mr. Dowd, who is one of the leading authorities on tooling methods and machine shop ef-Sciency, will tell how to get best results with boring tools.



Will we fly to the South Pole?

direct platte are fast compacting to frozen waster and desper plants a manuscring to fricted whether \$100 teacher plants a manuscrine min everywher. These that you all to be would find friend best took theme that teaches done took are peak home there are being to the first plants are not all the first plants are peak home the open a Build a \$1 of \$100 teacher are peak home to the took the first plants are to all the peak tooks and deathing \$7; that he to the bine blook in the tooks and for arranged \$1. Models of all \$1 of the first are tooks and for arranged \$1. Models of all \$1 of the peak tooks are tooks for a set flow \$1. There are tooks \$1. The first \$1

Sacal Accuptance & Supply Co. 148-465 Spr ug Street New York

THE PERFECT GRID LEAK

Provides a policies tamps of grid look resistance from \$ Provides a policies targe most effective grid leak rematance "

value for all tubes. Smal) grid condenser(0.00025) in sep-acute. Metal parts nickel placed. One hole mounting.

Electric Controlling App 293 Greenfield Avenue



Mystery

Science has found the way of add to head to a me beight. No beigh in her to your bencht. to open and make up as the large of bones by more color of the distance panel. Then to use maken at possible for you to some level with your tell of make Commerce was inexpensive, and evapore hip free and immission hollow q+=q+<</pre>

L GLOVER, Room 45, 469 San Garles Ave.,

Separation, Calif
Williams and indignation in the need in the fact information on how to

Name

New year own I have to hep better this amount book, and year recent could. Year a Franch in he Pathwister. This she would agree he would receive mile the part of matteres. A relitive tentiles to filtrait The Barter the the Indian the Published. These field, earlies in large republished their properties at our field promplete and acts the 57 hour. By severing only "" is a conclusive tentile to be been 2.2 high leasures of The Published. The Batteries are absenting and entered play weekly magazine which recent to prove sever week direct from the most of successfully the state in clear, the first expectation and platters, an electronest. Every state is direct full of successfully and make it my "A bigger house in that is new First on he if patter. Supplied that with the costs yet pure work to take. ne - Freif er beilfpeine, Sendorfet with I in today er pin winft be inte. The Publisher, Ziv Langdon Sta., Washington, D. C.

Cleared Up-often in 24 hours. you can be rid of pumples, blackheads, acto eruptions on the face or body, barbers' itch oczema, enlarged pozes, otly or shiny skin, stooply send mer your name and address today—no cost on obligation. The Ah. FONE mediated tested in over 100 000 cases mad the totlet water is simply maries in prompt results. You can repay be favor by talling your intends I not the loss a mile. WRITE THINK E.S. GIVENS, 63 Chemical Bldg., Kenness City, Ma-

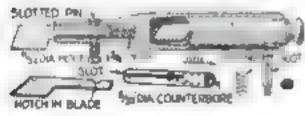
Better Show Methods

Sturdy Gear Puller and Commutator Tool

EVERY mechanic washes to have cer-tain personal tools for the hard little jobs that come along. Among those I have made and found useful on many occusions is the gear puller illustrated. Its



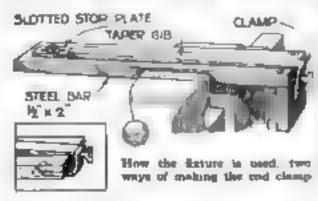
saving tool is that shown in the drawing below. It is for cutthat the mich moulation of minal motor commutators below the surface. A portion of a hack any blade forms the cutting element. The handle is made hollow to carry spare hardes, the cutting edges of which vacy in thickness.- J. D. Gronor.



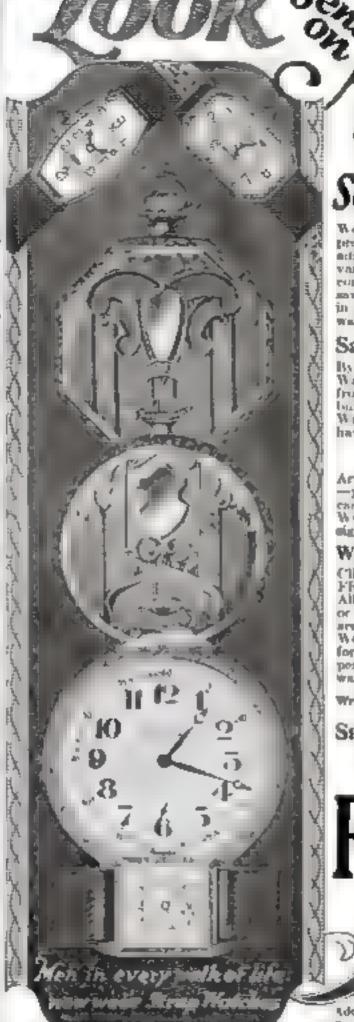
How the saw for cutting commutator quesis made. The whole tool is only \$ 1/2 in. long.

Vise Fixture Holds Long Gibs for Filing or Scraping

TAPER gibs, or similar parts, which require to be draw filed or scraped. are often difficult to hold in a vise. The



holder shown was made to clamp such work by the ends and avoids scarring it with ordinary vise jaws. The stop plate was slotted to allow for variations in length. The end clamp can be made in any convenient way,-H. L. W.



Adjusted to the Receipt Adjusted to re-chronisms. At usted to Positions 21 Rub; and Amphitre Jewell. About the Food Strate lane. Your choice of Food for a network of Monkenmen R Rubell New Ideas in This Case.

The 21 Jewel Santa Je Special

We will send this famous watch express prepare, for you to examine, is import, to achiere to approve a thout one seeiny advance payment. Examine the watch and be convinced it a the nest watch buy you ever in easy MONTHEY payments. You use the watch while paying for it.

Save 1-3 to 1-2 of Your Money

By purchasing this Famous Santa Fe Specia Watch Not by are you are of matery from the present day process of watches, but you can stan secure the Santa be Special." Water at the same low prices and terms that have made our watches famous.

Ladies' Wrist Watches

Artistic, dependable Indien' wrist watches —perfect time-serves, beautiful hand-engravest cases in white or given gold bend for New Watch littels und see the new shapes and decigna. Bent on approval and sold on payments.

Write for "Santa Fe" Watch Book

Clip the coupon, fill out and receive the FREE WATCH BOOK just off the press. All the newest watch case designs in white or green gold, fancy thapes and this models are shown. Read our cars, payment offer Wear the watch 30 days FREE. Watch sent for your examination and approval without a penny down. Nothing to risk. See the

Write for New Book Today and Select Your Watch. Mail Coupon.

Santa Fe Watch Company

3-30 Thomas Building, Topoka, Kartana (Home of the Great Seats Fe Rellway)

Limited Offer! With Survy Penin Pa Petrial, a trace tal gold bath of strain of st

> Santa Po Watch Company, 11-00 Thomas Building, Topeka Namese

Pieses send prepaid and without ob-agating your New Waxel Book Fire, explaining your No. Money Picket!* Offer on the Santa Fo Special Watch.

Address

YOU CAN BUILD THIS IDEAL WORK-BENCH-YOURSELF

THE pleasure of working with tools at home is greatly increased if you have a strong substantial bench with a good vite. One that also I as drawers and mot cabinets is a constant incentive to keep took in order and give them the care and attention they deserve

A bluepant of the Home Workbeach illustrated, with full size details and bils of materials may be obtained by sending as cents to -

POPULAR SCIENCE MONTHLY

250 POURTH AVENUE

NEW YORK





958 College Men

tell bow they keep their hair in place

If your hair is unruly you naturally wonder, "How do other fellows keep their hair in place? "

That is what we wanted to find out, too. Bo we went out and actually talked to 958 college men-to get the facts.

And here they are!—the hair drewing that college fellows overwhelmingly prefer to all others is-Stacomb.

Let us send you a generous sample of Stacomb, free-and after the first day you will know for yourself why so many fellows prefer this dressing.

Stacomb will keep your balt smoothly in place, all they fond

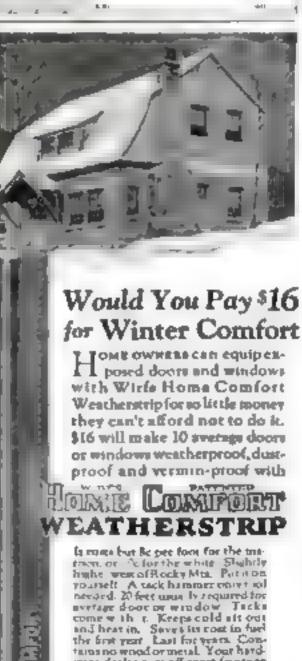
Yet Stacomb never leaves your bair greasy nor streky. Nor dry and brittle, in mater makes it Stacomb helps to prevent dandruff.

And whether you prefer the combing cream (in jury and tubes or the new Liquid Stacomb, you will find that both forms are equally plement to use and either one will readly here your hair in place. At all drug and department stores.

FREE OFFER

Brandard Laboratorses, Inc., Dept BC 1, 113 West 18th St., New York Send me free sample of Stacomb as elected: Original, cream form | New Land form |

Address



Beliter Shop Methods

Square Vise Equipped for Angular Work

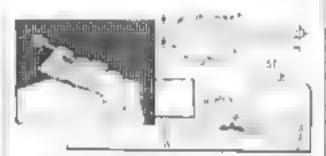
By HENRY SIMON

BY A simple method of angular adjust-ment, a small, square vise of standard type may be used to make abort work of many awkward jobs.

Two hardened pins are located under the gap of the vise so as to protrude about bi in, un each aide. These permit the vise to rock on the paws of a larger receiving vise. A protractor scale makes it possible to locate the vise correctly and instantly at any required positions.

The adea of the vine should be imouthed to a high finish by the use, first, of a flat file, and then by rubbing with a flat block around which a piece of fine abrasive cloth has been wrapped.

After the center for one hole has been marked with a fine prickpunch, its location is transferred to the opposite aide by means of an accurate square. This operation must be done carefully and should be checked several times. The prick marks



How to adapt a small vise for engular work and a suggestion for laying out the protractor scale in a simple yet accurate way

then abould be enlarged into center punch marks of sufficient size to guade the dedl.

The holes are made by the use of a No. 52 drill followed by a No. 51, the resulting hole being slightly less than 1/4 in. The holes should be deilled from each aide into the channel of the vine, to permit the pips to be knocked out if necessary

The pure are small precess of bein, dell rod, slightly tapered at one end. They should be hardened and drawn to a blue.

With them in place, the protractor scale aret are drawn, using as the center a prick mark just below and as close as possible to the pin. The degree marks are laid out on these arcs. The diagram shows the distances for a radius of 2 m., the distance being proportionately smaller or larger for other mdn.

Start by laying out the zero line, being careful to get it exactly parallel to the buttum of the vise. From it lay cust all 5-deg, locations and mark them with a priekpinich. After these have been checked, draw lines through these marks, tangent with the lower edge of the pur. Hold a scale firmly in place at each location with a C-clamp to allow a scratch awl to be used without danger of the scale's shipping. The 1-deg, marks then are prick marked and drawn in.

Where a surface grinder is a vallable and finer work is required, it will pay to great the vise on all registering faces, starting with the inner one, upon which the moy-

able jaw rum.

ware dealer curs off exact footage wanted, like rope, from a reel. No

wave. Be sure you per the principle. is a Jentified by name and foot-

E.J.WIRFS ORGANIZATION

114 Touth 17th St. - St. Laute, Ma.

Sole Manufactors and Permane

Bootleg Oil

(Cantinual from page 11)

oils and a specified brand, he still can pocket a profit of 200 percent!

Deception is made doubly easy by the fact that when it comes to motor oil, most of us rely on the statements of the manufacturers and have faith in their products. More than mostly percent of automobiles are operated by drivers unfamiliar with the principles of motor construction, fuel and oil consumption. When we buy libricating oil, we reay on the statement of the man who seles oil that he is giving us what we ask for.

When you go up to a filling station.

what do you my?

"Gnume five of gas and a quart of oil." is common enough. Perhaps you specify "light" or "medaim. 'Oz, more likely you give some such order as, "A quart of Bearcat, meaning

If the filling station man is honest, he gives you what you sak for, or says he hann't got it. If he mu't, he gives you

whatever he wants to.

CITPOSE you pull up for crask case D service. Two gallons of used oil are drawn off, and two gallons of fresh oil put in. You pay your \$2 and go on your way, leaving the drained oil in the pan that stood under the machine. When you are gone, the dishonest service station proprietor can pour the oil deaned. from your crank case into his oil barrel, after filtering all he can of the black shit and got out of it to prevent detection. That puts him just \$2 alread of the game. What does be care about damaging the cam of subsequent motorists who will buy that broken down oil? And what ammrance have you that your car is not running on worn-out oil from some other motorist a crank case?

Taking the very conservative estimate. that twenty-five percent of all the oil sold. today is poor oil, let a figure what it costs us in dollars and cents. In the United States there are some 20 000 000 automobiles and trucks. At an average cost of \$600 aprece, that means \$12,000 000,-000 worth of automobies. The life of the average car is shout set years. So that we have, in depreciation alone, something

Considering that a car wears down twice as rapidly when had oil is used--Bud actual tests show that that is conservative, too- then we have something like \$250,000,000 damage a year canned by the twenty-five percent of marketed wil that is bad.

like \$2,000,000,000 A year.

AND these figures, to repeat are ex-4 h tremely conservative. If again, we estimate the damage done to each of these 20,000,000 machines at \$50 a yearwhich seems reasonable in view of the recent laboratory revelations—then the loss is a billion dollars a year!

Professor Masson, in the report of his tests of oil samples, states that the use of these spurious oils is making worthless "millions of dollars worth of machinery." And Judge George W. Sunpson, Presiding Justice of the New York Commercial Frauds Court, who already has held sex alleged oil (Continued on page 136) No tears in these tunes!

Unless, perchance, they're tears of joy For there's only unalloyed pleasure in a set kept at its lively best with a Rectigon. Your batteries are charged with case and convenience. But more than solid comfort—there's no costly gnef. You'll shed

no agonizing tears because of spoiled furnishings, ruined clothes. You can do your charging wherever you wish. There's nothing in a Rectigon to spill or burn. No acids, no chemicals - and no moving parts.

when you do your own charging with

No Nulsa as it Charges

re got a bit of lust his mark a marcons hat would discuss in deat



The Westinghouse

Battery Charger

Saras Its Cost to Short Order

Coamiliae dollars specim a few troot on the serve esta-ting and you'd hardens in tor o He sgon for the mood tericont



your packet. book as well so your betteries.

Snaps On in an Increas

Jun phuganto the ight de b ch chap no be terminate Barrel service in dia bits her for a Higher more service right send as seed by alternat best certain.

Charges Both A" and "B"

- Kreyn both parked - ith prompt Buth to meet for B hoterty charts of and to etc church like all of other parts an



the garts and method according to the Resident R

Perfect Safety for Your Bot

Tyou tune opmhile pro 10 e h o f g t h E
there il the no
hadro or her to
set of the teres
Nist will first
tetres by dis
charged if a betting halfered
to he correct while year to be rure at all Recupon sattached

THE RECTIGON'S a paperb Westinghouse product Things you con face, like extra heavy insulation, things you can see, like the durably enameled case—all are of highest quality. Westinghouse also manufactures a complete line of radio instruments, and Micarta panels and tubes.

WEST-NGHOUSE EFFCTRIC & MANUFACTURING CO. Tune to un KOKA - KYW - W HZ KEKX

No Storage Battery Radio is Complete Without a Rectigon





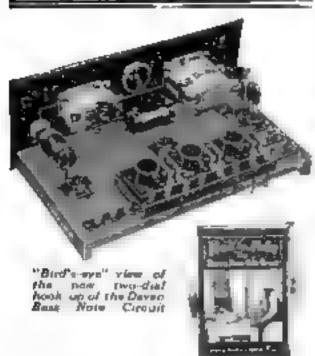




24 | Washington Sr. Sets to 5

🕦 TOOL CHESTS FOR PARTICULAR MEN Tootrakers and Ma-closists will find the right Case in our

> FREE CATALOG Setsu for it TO-DAL GERSTHER & SONS 533 Calamb a St. Chrysm, O.



And Nowthe Bass Note Circuit in a 2-dial hook-up

CLEARER than ever-even more selecof tive and always that crystal purity of tone-from highest soprano down to deepest, richest bass. The same autonishing Daven Bass Note Circuit with new re-Anconcota added

For matance, two tuning diele onlyinstead of the usually accepted three. An R. F. choke coll that prevents the radio waves from entering the audio amplifier. A special compensating condenser that increases selectivity, especially in long-dastunce tuning. And a brand new layout, requiring less base space and a smaller, neater panel.

Read "How to Build the Bass-Note Circuit"

A brand new booklet that tells you in the simplest, clearest way how to make yourself a Daven Bass Note Receiver. And a wiring diagram of an altogether new type

a boy can follow it clearly—shows you quickly how to assemble the parts. 25c per copy at any Daven Dealers' or 30c by mad. And it's worth ten times as much in the new kind of radio reception it will help you obtain. Get your copy now-while the edition is plentiful-later on, you might have to wait for another printing.



Bass Note Circuit for Complete Radio Reception



New Edition Daven Manual

This valuable book explaint Devite Amplification in full detail, and shows how to apply it to your set 25c at dealers, No by mail

"Stor Sine of Harid"

DAWEN RADIO CORPORATURN

rente com "Sterrinder Superiolisto" provenues by summer to neware it is Deven Catalog Free on Request

Bootleg Oil

(Confidence from Judge 129)

"gyps" for the Court of Special Sessions, has quoted evidence showing that in certain localities the substitution of pour oils for genuine has reached half of all риетымея.

"It is the duty of those who are directly saterested in guarding the nation of enormania investment in motor cars against undue depreciation and loss," says Justice Simpson, "to detect these fraudulent practices and bring the offenders before the last of justice."

YT IS next to unposable for the car where to detect substitution from the appearance of the oils he buys, and the difficulty is increased by the fact that many of the "gyp" service stations keep their stock of substitute oils in drams and cans bearing the labels of well-known standard oils.

"The detection of these inferior grades of oil is a job for an expert," says Edmont. A. Whittier, Secretary-Treasurer of the American Fair Trade League "I nder the microscope they abow up grit which may not be visible to the naked eye, but which soon runs the vital parts of the cug ne. "

Of course there are certain aigns that will tell you when your mater is trying to run on bud oil. One of these is an overbeated engine, as indicated by the motor thermometer or by a boding radiafor. Another is a low reading of the oil. pressure gage on your dash. Still another is excessive noise when the engine in running. But here it is usually the case that the discovery is made after much of the damage bas been done

THERE are two ways to protect your-nelf. One is always to purchase your oil from a dealer with a reputation for bonesty and reliability. The other is to buy your oil only in scaled cans bearing the trade mark of a reputable manufurturer.

When the legislators of forty-two states meet early next year to enact measures making it unlawful to sell substitute or spurious oil, you can belp to place these measures on the statute books, and to stamp out a growing national symdle.

Test Flier's Sense of Balance

AN ELABORATE new mechanism to avention students has been installed at St. Cyr, the famous officers' training camp near Parm, France. It is intended to test the sense of balance, as well as the sight and bearing, of the candidate

The young aviator places himself in a sort of mechanical armchair attached to the end of a huge framework resembling the wing of an aeroplane. His head is thrust into a dark funnel so that he cannot ace. The "armchair" is manipulated by electricity, and during the test it is jecked violently to one aide and another Delkate instruments register the time and manner in which the candidate reacts to the tests.

PRACTICAL BOOKS

RAISE YOUR PAY

WRITTEN in easy-to-understand non-technical language these books will help you in your chosen trade. Every book is an entire course of instruction condensed into one volume. Thousands of men have used them to merease their pay, You will find them full of information and ideas that will help you raise your pay

Painting and Decorating

Russ trans Book of Home Parmitung and House Pauling Methods with the Buds and Spray Gue by Vanserwaser Interior Wall Decoration by VariderWalker Leathers to \$4.00.
The M may of Colors and Lauria 15 Vanuer. The M trop
we ket
A Shew at Shew ards
Sign and up by Atkinson Cluth
Strong a Besit of Dragest
Leatherstie \$4.00
Strong a Besit of Dragest
Leatherstie \$4.00
Strong a pair of \$2.00
Strong and Strong Cluth
\$1.50

Steam Engineering

Samuel's Handbook for Starm Regineers and Electricians. Leather-its \$4.00 Examination Questions and Anguers for Marine and Stationary Sugments. Leather-its \$2.00 Secure Business Leather-its \$2.00 Symple's Catachian of Starr and Electrical Engineering. Leather-its \$1.50

Carpentry Books

Cloth Borden

Modern Cornentry & vote	\$3.00
One Steel is mare 2 Woln	\$3.00
Made a Face water	\$1.50
Timber Pearsing .	\$2 00
Builder's Aschrisctural Drawing.	 \$2.90
Concretor, and as as	 \$1.50
Practical Bungalows .	 \$1.00
Roof Framing, by Van Gasbeek.	\$1.60

Electrical Books

Telephony Including Automatic Switching, by Smath, 450 pp. Leatherstie \$2.50 Practical Applied Electricity \$2.00 Wiring Diagrams and Descriptions Armature and Magnet Windows \$1.50 Electric Motors, 12 & A \$2.60 \$2.00 \$1.50

—the books you want and mail today with your remittance.

We will send you the books you order on our guarantee that if you are not thoroughly satisfied with them we will return your

POPULAR SCIENCE MONTHLY 250 Fourth Avenue New York

Popular Science Monthly

Centlemen:

Please level one the books I have checked for which I enclose my remittance of S — I am ordering these books on the bases that if I am not satisfied my money will be refunded.

100



In 6 Months

H. G. Stewart made that amount in a new kind of real estate business, that is giving ambittous men and women more money than they ever thought possible. Learn the secret of their success. Use the same money-making system. Soors a big-profit business of your own-right at home- to your space time-without capital or experience. Full particulars and positive proof of amering, money-making success, mailed free. Bend for it today.

American Business Buildon, Inc. CAuthorized Capital \$300,000) Dept. N. i., 18 East 18 Street, New York



Saws Wood Fast (Does the Work of 10 Men—1 / 20 Cost)

This one-profit WINTS Log flow time Revocens, Can-Oil, Entillate or Capultur and wild cut from . It to 20 service of word a day. Easy to operate and move, New device making may next against the day of the properature. Transfer-proof, Completely equipped with WICO Magneto, agreed and power regulator throutling governor and 8 by wheels. Falls three and sewethers into blocks—runs other farm mass blocky. Fast money makes a and beginned deven.

Sold direct from factory to you on your own terms.

Proc Write today for New Feer Book and Low Ener Payment Prices. No obligation. Or, if interested, sak about Engine, 3-in-1 Saw Ries or Purity Outline

WITTE ENGINE WORKS 7222 Witte Bidg., 7222 Empley Bidg., 7222 Witte Bidg. Pittsburgh, Pu-printered Cal-

Quick shipments also made from necest of 25 wacehouses.

HEAVEN and HELI



By Kmanuel Sundenburg This book of 633 pages, or any of the following works or Swedenborg, printed in large type on good paper, well bound in stiff paper covers. will be and prepaid on receipt of 5 cents per book

Divine Providence Treats of the government of the naivene and of the homes soul by the lave and window of God emonasting he fundamental need of freedom in the life of man

Divine Love and Wisdom Shows that the D vine Lave is the fountain from which all things proceed gives also a philosophic outline of the primary processes of exection.

Heaven and Hell Kl2pp.

An epoth marking reveittion of the conditions that previal in the sporton, world and of the laws under which each man finds his immortal abode. THE AMERICAN SWEDENBORG PRINTING
AND PUBLISHING SOCIETY
Room 519
15 \$ 4612 Street, New York 15 E. Sten Street, New York

Chemists Vision the Future

Contract to the same of

decorations. Dr. Wendt gives the following astonishing description of the homes our children may live in:

"The house of the near future may well be built of steel, with lacquer finish. bakehte furniture, composition floors, artificial leather floor coverings, and rayon draperses. These are all synthetic and composition materials not found in nature, and they all release wood and the natural fibers for superior usefulness as chemical raw materials.

Metals WITH 75,000,000 toros of metal being consumed each year, the end of the world a supply can be recknied. Whise there is enough from to last for two or three hundred years, experts say, at the present rate of consumption copper, sinc, his and an timony will be gone in thirty years. To replace them chemists are developing alloys that will not rust, of great strength and durability.

Two synthetic metals, duralumic and magnetium, are among the wonders of our day. They have murie possible the construction of the modern arship. Agazo, such allove of steel as chromoum and variations, far stronger than steel. have given strength to deheate high apeed machinery

Meanwhile chemists are devising ways. to salvage and re-work metals from the nation's junk heaps. Today half of our copper, three fifths of our antimony, one eighth of our gine, and two thirds of our tin-are recovered each year from America's trush piles.

When this source fails, we are assured that substitutes for the metals will be found. For example, when the is no longer available for making food rentaspers, chemists are certain that the familiar tin caus will be replaced by composition containers, possibly of waterproof paper, fined with hard, waterresulting because.

Rubber Synthetic tires from petroleum are an actual achievement of the laboratory, though not yet developed to a point where they are commercially practicable. It is estimated that from only a fraction of the crude of produced in the United States last year, there could be produced four billion pounds of rubber, or ten times the present consumption in this country. Rubber also is already being produced, as are paper, cattle food and fertilizer, from the commun mulkweed, while another chemist. plans to make rubber from California

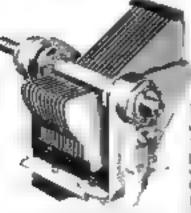
The list of synthetic products that are coming into the more and more every. day could be continued almost undefigitely. It would include many lands of drugs and medicines (the latest made from scrap leather and old shoes), new quick-drying paints, the many meful compositions derived from resistance even artificial perfumes that duplicate the fragrance of living blossoms. The list makes us gasp as we wonder what will come next.



The First UNIVERSAL Condenser

The New Hammarlund

With Full-Floating Rotor Shaft



Avoids Crowding at any part of the wave band

The New "Midline" condenser has every refinement learned from Hammarland's In years experience in the man facture of precions in-Made in all etruments. standard capacities—single and multiple models. For sale by the better radio

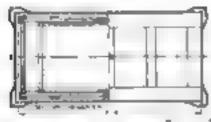


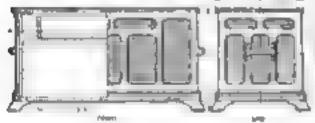
HAMMARLUND MANUFACTURING CO 424-438 W 33rd Street, New York





A Cedar and Mahogany Chest You Can Make at Home





Above are the working drawings of an unturally beautiful chest that can be built of Tennmen red sedar trimmed with makegang

PEW pieces of furniture that the home worker can make will better repay his efforts than a cedar chest. When it is trimmed with mahogany it is a very beautiful as well as useful piece of furniture.

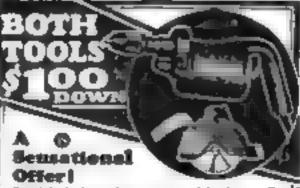
The chest we show the working drawings for is 3 ft. a in, long, 17 in. wide and 19 in, high. The sliding tray---which greatly increases the convenience of a cedar chest is 414 in. deep.

Complete working details are contraned in a blueprint obtainable for asc from—

POPULAR SCIENCE MONTHLY 254 POURTH AVE.

A 2c Stamp

—will start you on the road to success. See Money Making Opportunities on pages 134 to 165.



Look! A Speed Way Portable 16 H P Electric Drill and a SpeedWay Portable Electric Hand Saw can now be yours for a trivial down payment.

Easy Terms

Pin a \$1 00 ball to this evapor. Mail it today! We will ship both Deal and Saw to jour home postage prepara.
Pay the posture \$10.00 and the balance of \$20.00 in two months, payments. We will include absolutely free 2 drill late.

Speed Way Quality
The Speed way 4 then 19 th will drill heles
to steel faster than any tool you have ever
used. I denies the San to a storch, compact Both tools asted the world over for high

Send in the Coupon

quanty workmanship

floo't bentate! This special offe is hosted. We guerantee satisfaction—or your money back let new?

ELECTRO MAGNETIC TOOL CO. Dept 1311 1830 5. Slad Ave., Clears, 12. Considerate More in my \$1.00 bolt flowed one the formula my Electric First and Speed Way Hain! Saw me and it turned. Where delicered it will pay the procumes \$10.00 and return to great the behavior of \$20.00 see may have not \$10.00 per manual. Due 's foregree to expected a drill have from.

Name

Address

Marvels of Light

(Continued from page 35)

the heater which was being advertised. The heat beam was much like the beam of a searchight, which, indeed, is concily what it was. The only difference was that the rays were longer in wave length. They came within the black light range and were invisible to the human eye.

The other form of invisible light, the kind used by Dr. Wood to light up his ventor's teeth, lies at the other end of the spectrum from the black light. The spectrum consists, you remember, of the seven visible colors into which may white light, like smalight, is split up when it passes through a gass prism. At one end of this colored strip is the red light. Just outside this, where it is invisible, is the back light or heat my. At the other end of the visible colors is the violet. Just beyond this are Dr Wood's anymbic rays, called the ultra-violet.

HESE ultra-violet rays are now being need underly in the treatment of disease, especially of the children's disease called rickets. They are responsible, also, for most of the surburn you suffer to summer. There exist certain chronicals which are opaque to the ultra-violet rays. just as black ink is opaque to visible light. Paint your skip with one of these chemicals, some of which are invisible, and you can be in the sun all day with never a fear of supburg.

The effect of these ultra-violet rays in making teeth and other objects thing has found a striking appareation at the hands of M. Jacques Risler, a young scientist to Pares. In M. Risler's laboratory you see a small statue, apparently composed of marble or porcelain. The room is darkened. Suddenly the statue begins to glow with internal light. You pick it up. There are no wires. No light beam seems to strike it from without.

The accret is, of course, the same as with the teeth of Dr Wood's visitor. The statue is made of materials which shine in ultra-violet light, an invisible beam of which is thrown on the statue from a concoaled generator.

CCIENTISTS call that recontinued radiation of light "fluorescence," It is of special interest because it is cold light. No heat accompanies it. In this it resembles the light emitted by fireflies, by glowworms and by other luminous living creatures, many different kinds of which are known to the naturalists. William Beebe, the famous naturalist, of the New York Zoological Society, has even described the existence of a South American beetle which goes equipped with two greenish lights in front and a red tail-light behind, for all the world like some tiny flying automobile.

In the depths of the sea the majority of creatures seem to be equipped with light-producing organs of this kind. If we could devise some diving ant capable of descending a mile or more below the surface, the sights would be astounding. Here would be a great fish with a light hung out in front of his mouth, like a labtern. A luminous shrimp would swim pest, glowing all (Continued on page 183)

Marvels of Light

(Contraval from page 1.45)

over with a bright bluish light. Next we might glimpse a fish with rows of shining light spots down his sides, like the lighted portholes of a steamer. There is even a creature which discharges a luminous fluid whom frightened.

Professor E. Newton Harvey, of Princeton University, has codected in his laboratory varieties of living bacteria which are so luminous that a flask full of them, fiving in culture solution, gives enough light to read by, even to take

photographs,

Certainly, it would be very useful to man if these tiny light factories could be trained to live on the walls of our rooms and give us light at night. I afacturately this is not likely. The light is produced by a rather complicated set of reactions between two different chemicals produced by the bacteria. These chemical reactions are not especially efficient once. There seems no immediate probability that cominercial "rold light" will be produced by any method emulating Dr. Harvey's flasks of huminous bacteria.

MUCH shorter in wave length even than the teeth-diumnating ultraviolet rays are the marvelous X-rays which surgroups use to penetrate the human body. Shorter still are the rays emitted by tectuon. And finally, as the shortest waves of light which science has yet found, are the remarkable cosmic rays recently. discovered by Professor R. A. Milakan of the Caafore ia Institute of Technology

To discover these rays. Dr. Molakan and his assistant had to climb the tallest mountain in California and then swim in a lake there. Close to sea level, the detection of these cosmic rays had proved impossible, there were too many other rays about. The snow water of the mountain lake proved free from these disturbing rays. By sinking their detecting apparalus sixty feet deep in the waters of this rescold lake the scientists. finally obtained the measurements which proved the reality of these waves.

THESE comme rays are believed to A reach the earth from somewhere in the depths of space outside the earth, on one knows from where. It has been suggested that they come from the spiral nebulas, vast universes of stars at epormous distances from the earth. One of the most marveious of light a wonders is. insteed, the fact that by the use of light rays our astronomers have been able to study these distant universes and even to measure how far they are away. Professor Harlow Shapley, of Hazvard I or versity, has just measured a group of them. which he finds to be at the almost meoncervable distance of ten million lightyears away from the earth.

Remember that light travels 186,300 tailes in one second. Then imagine how far this light will travel in a year. Then multiply this by ten million years. The result, in nules, is a figure of twenty

digita,

That is the longest distance yet measprod to the potverse and light as the yardstick that enabled us to measure it



Ship Model Plans

and matructions, Easy to hulld and self modern. Magellan's step, 7°c tudants Half Moon, 12a Chapter Mic Santa Maria, The Column Harts Ship, 530 -all for

JOBBERS: Whe for appropriate that the liver Acctual to making

etrojima de il Reel Agrida lor

troteur mertain, parsaulo enta, in travelera a il d

post of the state of the state

SEA ARTS GUILD MILWAUKEE, WIS.



EASY TO BUY EASY TO FLY TheLINCOLNSPORTPLANE



The LINCOLN MONOPLANE



Real performance in a light Monoplane Blue Prote are the size A Motoreyeto cogase will give Rive this place real performance

OUR NEW AIRCRAFT INSTRUCTION BOOK, F. IGHT tells you have Blue Prints of both planes on operad sale NOW! Need 25c for illustrated book and constructional details.

Write today!

ENCORN KTIDIDAKII ABICIALIT COMPON LINCOLN, NEBRASKA



Machines Armittures, Lindercuts Mica, Makes Bushings,

Referen Valven, Machirem Pietren, Pita Fisten Ringe, Cuta Torrendo, Drilla Escem, Turne, Grinde Fice, Fellal-reand & Schundreda of other acts. EASY to OPERATE

Act to mechanically infilted on pro-crease a good sparatur. Free flavil at metaction. How will a Lather new pape with again marking. Hirate for Bulleton Ma. an A.

SOUTH BIND LATHE WORKS





Money Making Opportunities for Readers of Popular Schance Monthly

You Can Learn Electricity in Only

Weeks

Earn Ũр to \$200 per Week



You Can Earn More in Electrici

Got training in the Close, Fascinating Profitable Field of ELECTRICITY COYNE Trained Mon Are in Domand. Here was specified, but shows a nonsether of an amost even profitable ambilious fellow. Why not make they not large an apid most profitable season. Unced a segment the great, interesting city and place the engage or as the area of the engage of a section of a property protects, in 12 hours we have a course to the property of the engage of a participation of a passing opportunities?

Complete Electrical Training in 12 Happy Weeks -Not by Correspondence All Practical Work-

I have started thousands of mes, young and old, on the read to success and independence. I can do the same for you. I teach you everything in

Electricity from A to Z by peartical instruction. Nothing that will help to make you a success is

Experience, Education—Not Needed

I can teach you electricity in 17 weeks, regardless of your education or experience because I teach you every detail in a simple logical, PRACTICAL manner letting you work out problems on thousands of dollars' worth of modern sixterical apparatus in my great COYNE shops. My instructors are trained uses with years of ex pertence

Learn in Chicago, Electrical Center of the World

Chicago is the greatest electrical and industrial center therefore it presents real opportunities for you. Along with my shop training you visit

the big industrial organizations and power plants and new every kind of electrical equip-ment to operation, on every kind of job under all conditions.

EARN While Top LEARN

My Employment Department being you get a job to care a good part of your expenses and assists you to a good job on graduation.

Heer WGES on the Air Listen in on COYNE Radio Station WGES: wave length, 250 meters. Always an interesting

Send Coupon for Big Free Book

Particular de la contracta de

H. C. Lewis, President

Coyne Electrical School 2100-10 W. Marrison St., Bupt. 90-75 Chicago, Misselv

Donr H. C. - I thre want one of those hig handsome 12-th books with 16) actual photographs printed in two culors. Send it quick without obligating for Alan tell me about the Price Rathman Prove and Two

Name,

Address we seems

Right now I am making one of the greatest offers ever made by a Practical Training lost station. My offer taxing the PERAILROAD PARE to Chicago from any place in the U.S., aims extra special PREE Radio and Auto Courses. Be sure to send the coupon AT ONCE, even if you are not plaining to come interdately

ELECTRICAL SCHOOL

Founded 1899—27th Year H. C. LEWIS, President

1300-10 W. Harrison Street Dupt. 86-73 CHRICAGO, ILL.

CASH PRIZES

For the best letter of 170 words or less answering the question -

"What advertisement in the 'Money-Making Opportunities' Section interests you most-and why?"

we will pay on December 10th the following-

CASH PRIZES

First Prize \$10.00 Second Priza 5.00Third Prize 3.00 Seven Prizes of \$1.00 Each 7.00

First read every advertisement in the Money-Making Opportunities Section on pages 134 to 165. Pick out the one that Interests you most and then write a letter—not exceeding 170 words telling us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on November 1st. The prize winners and their letters will be published in the January (saue of POPULAR SCIENCE MONTHLY,

Address your letter in

Contest Editor

MONEY-MAKING OPPORTUNITIES POPULAR SCIENCE MONTHLY 250 Fourth Ave., New York

PRIZE WINNERS

in the September Contest

PIRST PRIZE \$10.00 J. R. Loods, New Orleans, Lo. (Coyne Electrical School: SECOND PRIZE \$8.00

Gertrade Peters, Spokuce, Wash. (International Correspondence Schools) THIRD PRIZE \$1.00

51. A. Bru ers. Boritisheld, Dhio (La Salle Extension University PRIZE WINNERS who receive \$1.00

mach for their letters. Robert B. Milner Fort Barrengts, Pla. (Coyne Electrical School

Mrs. J. H. Bohn, Clinton, Ky (Popular Science Monthly Bluepeints) J. H. Rister Tye Texas (Dyke's Automobile Bocyclopedia) School Burstein, Bruca, N. Y. (Standard Business Training Institute Eines Davis, San Francisco Calif. (The Pelman Institute of America) Frank G. Devis, Springfield Ohio W. L. Evans School of Cartocoing' E. C. Greece Gallipolis, Ohio (Coyne Electrical School

Get the Book

That Doubled Stephens Pay in 7 Months-Boosted Everett from \$125 a Month to \$550, and has helped THOUSANDS of others

Sent Free / Nail Coupon!

Here is an unusual book—different from any you have ever read. It tells how men make more money, and make it more quickly than any other way.

Thousands of men have sent for it and found it the shortest route to a better job at bigger pay. Maybe it will help you, like it helped Stephens, Everett and Lamb. But don't miss this opportunity to find out. The coupon in the corner will bring it to you at once—by special delivery mail—so you can decide right away, for yourself, just what this book can do for you.

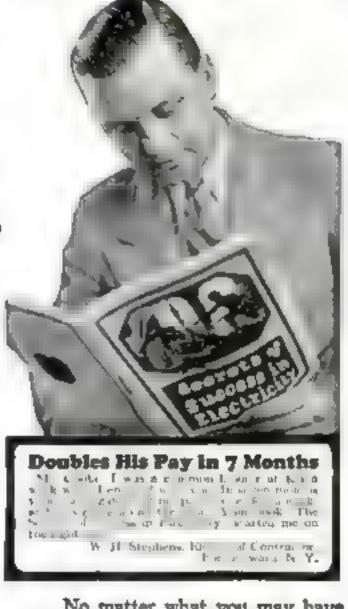




The Key to the World's Fastest Growing Profession

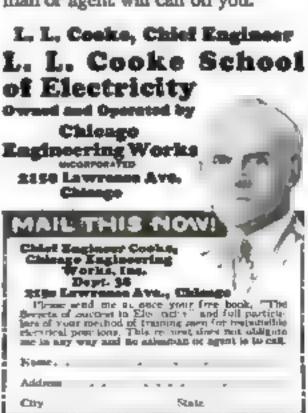
"The Secrets of Success in Electricity," by Chief Engineer Cooke, tells you in simple language, all about the wonderful new opportunities in Electricity and all about its opportunities for you.

Men of all ages, with or without electrical experience, are urged to send for this book. Don't lose thus chance to learn what others have done in Electricity, the greatest and fastest growing field in the world. In pictures—nearly 100 stones of success and how it was achieved—dozens of different electrical jobs and positions fully described—you get all these in Chief Engineer Cooke's big book. Clip coupon for your free copy.



No matter what you may have heard about other methods of electrical training, you don't know the whole story until you get the facts on what Chief Engineer Cooke offers you! You owe it to yourself to invest a two cent stamp in finding out about this amazing, practical and successful way of training.

Send for "The Secreta of Successa in Electricity." Read how, in your own home, while keeping right on with your regular job, you can easily and rapidly fit yourself for a big pay position in this big pay field. Mail the coupon today—it places you under no obligation and no salesman or agent will call on you.



Opportunities for Readure in

Quick Action Advertising

Adding Machines

Fig. 12 and marvelous new and gillion of Arbita substraints, male does discrete dutiment stay. We see sports \$10 me stands for P. see . \$ no Specify du sale hands due h. we year glusters w. The displayed substraint see the part of the ly al aller a Raterial Michigan

Advertising Services

A Valid 41 in 14 met repolitan dazien 14 worde.

6 5 st. 14 p. 4. Cuide Bering 1400 gubilentions, de
Francis Waste Company, Habitmore Bide., Chicago,

4 st. 14 te. 1 te. 15 section, \$1.00 feet and are

41. F. 1a tern 45 and 5.

O' Ph. in go a protest is deter Doublets, see, that pull Howard, City on in Building Phile.

Authors and Manueripis

1 WANT some posens, County Nation, J. \$544 Na.

164 Prefs of the Photombay photo completed in pay-pring W. II works the Erre bankley of a respective to interpret 26 h Scott By High Digits Myssen & Workship in 1864 would diff

pt in Prices Wiveren Wet a May Butweet Life, and November Life, and the San Prices we can a nigroup blackway a rept law, new York.

I WANT many positions of different groups of them. Birth-

Automobiles and Accessories

3) (5 M) is no fig bord Model to become by the lower mile, note with figs to on the model prime and harmonic filtree of ten from the dispute Wester Ingelod Elementary Francis in building.

N. M. and used mater party. Many 2 a brill. Med one, then seed to the party of the control of th

CAYMINON.

Title time team method of the new attractation a ment our regardeletes restrict in the transition of a trace. A life resists with the post bear of the little therefore, Petronic of the time, super 675 Store Windsapan App. Still agent officered.

the tast fixing sample principles of fixing the fixing sample principles of fixing the f

Will Air I Hade II Ask toda: For a copy of the Court Action Adversaring Hate Force: It wills How Your I blue to know western Mounty Principles to the Advertising Personal Advertising Personal Releases Mounty 250 Fearth Advertising Personal Releases Mountain 250 Fearth

At These rigities TVV-8 Chang & day for First Monage for Phase, New States States from one 12 of the Atlantage and Phase Proper States for Carabase Managers as Africant in 2.8 Very Paul Terrary States in 3.7 All Marine Managina Che aleman Managina Che aleman Managina Che aleman Managina

WANTED on their fineres of its extering rather at a to for select densit her has the attention and the air Arraphase Deca Box of Person. If

1 1 10 Time Tules or Record interference on including Pull Man Plane with the time tracking Flood in at the Properties State Management of the postpoid Flood for the resided Airphane and Head Chilater, he Philips College, 20,7 Wilson Avenue, Breethys, New York.

Boots and Launches

APALS V book brook properties each togeth bipage to their times together together the property to the property to the property to the together than the together together the together together the together toget

Books and Propodicals

FUNNY Witts Mule magazine including analyst peoples movely, 10c. White Mule Reaser Paus, Wit.

[4] Retain all Expressionate Master has Translated Private of Contract Private of Will." Over 400 Pages and 30 No. 2014.

[4] Private of Will." Over 400 Pages and 30 No. 2014.

[4] Private of Will." Over 400 Pages and 30 No. 2014.

[4] Private of Will. Over 400 Pages and 30 No. 2014.

Branch Offices

UNCONNATI Address \$500 Forwarded Delli-

Thurspent of the 1 h as M. M. Monthly Beauth Office and information Service Robertons, 000 Inventoral mited to fore Building

PART FRANCISCO MAI Address fil. Monthly Ross Fubil Herotco 440 Managem Street.

Ratus 30 Cents a Word. A 10° discount in allowed on all contracts for no consecutive meetnone. Advertugements memded for the Jan., 1927 wine should be received by Nov 5th.

Burrers Opportunities

a contrapt of color of one of Anna da realist experiment and log a log Northly such plantal of a 1 year of security Law Mountain. Playsh, عال بطلعت لا

a bit is the content on the authors and there is blick the a linear stage the bits a life in the first particular in the first

H . Ib a bont accomment & New Profession He is a book depresentation of New Profession and Section and Section 2. In these on the section a could be from a following a section and these of a section and the section

PATE VIN presumed Trade Starts Registered A Publisher and the property of the property of the party o

with the time to the partial and the state of the second terms of

A A 1 1 No. of the state of the powers bushasas. Which wind address with a state of the party of the state of the party. We state the state of the s

Heremontal in in every factors in the Popular Melance Monthly 200 Pourth

part of William V manifold force by you We for the Pour to red force are particularly on Wildiams of His law to there is state.

t P god down prod a. Why trye's In the a net My. het such in point by an ad give or by a dection who is can let a be profit of her ar both man a From bushle replaces. Paul Rays 14 Propeluge Y

Mind he read new a parameter than a run of the parameter than th

The by an Weart of a

pt 1944 good Micro wards emists general with Letter Pas store I Angle warms will at Sex Emil same. We is ted from each dev. John Ha is. 2 Jul Nova And. A Sempe

while I had now being out to an unitrod said that a little for the I am to II will find a contract that the little said being grow the unbestioned domained. Subjective and appropriate the little said said. I will be said and the said to the said

Bit a subject start apper over mail series breathjus from the fill a platform of a New Action and the alger for the fill a subject of section self-on alger for the restriction place for Names or Science.

Part of 10 forman Manufacturers \$1.00 (t f f)

SDALE IN IS SHE count per maper. In brook.

SIANS AN Exit form that at proper on that the part and about the part that moving makers that a for that from a laboratory that it is a laboratory than the part of the part o

MAN FROM The New Page trading Named the tests properties a special product and the page trading Named the tests properties and the page trade of the test of the t

14 (41) (45) Mad Clyster Metheds," is detailed brush that trimp Patrick rep Patern Mahman (n. P. () Ber 931 t midst fre Petersinted

he we can let a la estatamal Advertising entalogue Postpard che trut Agency

R. 42 S.F.54 Opportunities write In Julius Raphie. S. das S. 61 of S. A. S. S. S. S. S. S. S.

Blue Prints

The man who has a House Warkatop and likes to make with a said. Popular increme Mon h when a the manufacture is no particles of the properties of the particles of the same regularity to particles of the barpe. The following over a few of the bitter manufacture. As a few of the bitter man, we a few of the said of the

Busmett Services

Pri 47 VI list Printidents had set all hinds huping and ing majority an expense has some ad it all gight a different grift on passes and space of hinds a security of Long from some a compressor by analysis semagnets appropriate the complete semagnets and product the long from the language of the complete semagnets and the language of the special line of the language of the langua

Chalk Latter

1 54 M producing program, \$140 Catalog Iron.

Distributors Wanted

With 1998 fascent setting nato necessory. County distributions wasted with to lay 4. I. W. Spring this of wast these Latinovias.

WANTED - Representatives in every factory in the Order State | County Service Monthly 250 Jours & No. 100 Persons Monthly 250 Persons Mont

Dogs, Birds, Fuh

1884 I by the area tall pupe chesp highlings, but seek and the state

if Hr. Inn ug Hounds throup a shupe Rhebmetrinols F t M N Y

1) (that I deput of engineers and And brief field apparent quality we region to be applied to a late of the second and the sec

Education and Instruction

a 1100 with NIAN ALL Learnings and respective by the range of the database with the learning many manual property the exponential to the soul data evaluation to the light specified in the adopt of the world implies the database in the continuous of the latter on the SAL NIAN ALL SALE AND ALL SALE AND ALL SALE.

complete to a language of the design of the property of the factor of th

pe 10% Selectories por Land Bedeltele in About he les to the first the selectories of the first tenth of the selectories of the first tenth of the selectories of the first tenth of the first tenth of the first tenth of the selectories of the

are of the ty frankher day tage error in 00 filespen at the term grant species of depletons and properties of the term to be a grant or the term to

h I m of a press nonlinear School Convince and Delph & October Hembe to up to 11-4 th across Ha glade to ach largue From I at Cong Tolk h Propose Non-Local horse

6 R Suller tiplets to Buth 4 h tiefs of dis Atalience of Bisers on Any sullivers. Writing buy or are 3 4 Hactor Version Mile.

14-14 Section (teacherspling Since Sand Types stilling, Section 14 Sections (figures I present) has and over tille other reaching Sections, (ambit by mail a section of the section of the

Electrical

TOP Light the ign is Not ing Atlantique By P. P. Preng plant F. F. in again all he into one impression for the process and all the interest of the process and in the highlighten in the state of the process and again the highlighten in the fraction in and tenthing to according to the fractional liberate guide. I must prove interest the highlighten in the fraction of the fraction blood that the highlighten in the first part of the fraction blood that the highlighten in the process of the fraction blood that the house of the first part of the fraction blood that the house of the first part of the fraction blood that the house of the first part of the firs

Financing and Investments

Tembers on a major able some bis brank C beserbt.

For Boys

FREEHTAIN MEN'T for Boys! Her latest Morte Market Market Market and durable Press Toron are just the Chang to real plat Carakters Free L. F. Miller & Carakters Free L. F. Miller & Carakters Free L. F. Miller & Carakters Mass

For Men and Women

The Transfer of Mark house or heavel haperhology welcomes and William Company Magness forthest Consetts are before up to the Consetts and the Consetts and the Consetts are before up to the Consetts and the Consetts and the Consetts are before up to the Consetts and the Consetts and the Consetts are before up to the Consetts and the Consetts are before up to the Consetts and the Consetts and the Consetts are before up to the Consetts and the Consetts and the Consetts are being the Consetts and the Consetts and the Consetts are being the Consetts and the Consetts and the Consetts are consetted as a consett and the Consetts are consetted as a consetted as a consett and the Consetts are consetted as a consett and the Consetts are consetted as a consetted as a

NIR ALANDER THE M. And odes for a copy of he trief Ar how Ad exceeding Place builds. If containing there exalts amount has been which an proper interesting and about to the new Harden to be the many property of the following making any Aristoness was registered to hispatist interested Advertising Property to hispatist interested Advertising Property Advertising Property.

A excuss as busy pull of less but tary less three 11 00 post part Personal Participant Name 1.0. Viol. Ukishaita. FAN: Y hand starning all loss her mappenders



Formulas

SP 4 this Permitte for Manufacturing and Heatered burgamen. Ally one you want 15. You must be terrained of your mount of the refunded permits. Natural Information Hydrox, 316H Shepard Parking, Grand Rapids, Michigan

Bapide. Michigan

MAKE 5: 11 Your term Comps. Formulae Processes. All sands and base. Catalog, circulars from C. Thatly Co. Wash at one, 3: 1

1. End I Al. Superi Formulae Manufacturing Formulae and Processes on a learning discribers Religious and Processes on the Charges from Religious terminations at 150d. So the C. Therein from Religious terminations at 150d. So the Charges from Resident 5: 8 Sec. 8. Satisfy Charges.

If SERFIT AN for Industry or Business transcapped applications new Jersey Laboratory. No. 5: 7 St. Paterpool.

500 F. 16521 CAN 25c Cutaking From Injust Book Shop.

For Inventors

The North of the control of the state of the control of the contro

Party National Control crinitaret Parented or ne-ntenced Writing volume Public, hilly Co. 123 Fortight 29 2019, No.

within the Representation of the story factors of the Mind Health Popular Herodor Municipal and Federal United States

United the size Papellar between a until 1980 hours have New York Cert this papellar in this is not not not the papellar in the new that it is not not not the new transfer of the new transfer of the new transfer of the papellar in this we note to the lowestors of where the head related of many transfer of the next to the new transfer of the next to the

Type N Police of factions to assist develop and fastiset your ment countries and on complete service will affect to be the linearises determined by the linearise

For the Home

HOT WATER ON TAIR 26. Make your own A do-matic. Write John Kirksby, ean Loke Höleph, Laist

CHANNEL A THE Majorn which do it light may make the food gather that exclude the ingle good profile withing your friction. Check works at highlights for old or him cases. Write her full partie its a. Check to Steelman, Prince

The thre empty who bised for work of the book. Property the book bised three books are the compacture of the books bised prints in the compacture of the books are the boo

Help Wanted

Here I II, No. Miles on F much place Facility bearing featuresses of the Place from West Mileson Works of Exercises that I Place from West Mileson Works of Mileson of Mileson delta and the Mileson of Mileson of Mileson Mileson of M

15% Y unforth. Breake \$ 5 per prior 5 pert 5 hill or apare time. Now the by general in the breakest Prior to see the parent of the breakest Prior to the parent of the breakest prior of the parent of the breakest perturbation and the breakest for the breakest parent of the breakest parent of the breakest perturbation of the breakest p

PATING FO product approved by Court House-beeping and already sold hundred of the annual of temperature House where, now approving local management Manager House White, now appointing freal cameanors. Manager Bir.

WANTED Representatives in every factor in the United States Publish Science Monthly 250 Fourth

HTV 4 NTSPIT problings—Furgue Problem Came Experience unindepents limb of quantities free 122.5 Mount version N Y

Min No W. Min's wranting T. H. coast post once. 1742 \$225 months: stead, experience or representationed course unnecessary details from Wifts V. Jaradford, 112 Hermot Jersey Chy N. J.

Help Wanted Instruction

DETENTIVES Eath Mg Money Excellent opticities; The et. Parking ing work. Experience unbedougly With George Wagney former Covernment. Detect on 1869 Broadway, N. Y.

FIREMEN Brakemen, Bangacanen, (white or colors is sharing ear take postern schirette \$150 Tills monthly Figuriance emagnizatory \$18 Railway Bureau, Nast St. Louis, IS.

Help Wanted Instruction

MIN wanting forest rather rady ar mail elect, and her got posttions. Write for particulars. Makana, other goar positions

215- to-422 to MitVIH Radinar Mad Clerks Parts that with sample south at FREE Write Instructional Franklin Lieuteka, Orga, C33 Reclaster

VIR ALIVERTISER Ask vodes for a copy of the Cruick Action Advicement Barry budge its contains barry colling the popular force white most proper interesting an emblantic to you it alone to the How You can see copylar Science Montally Protected You date to know weakliby you Address cour inquiry to Manager Cleanaged Adversary Propagal Science Montally 236 to 5.5 when New York

How to Entertain

PLAYS, mindral competter and private introductions of the late that the called the private introduction of the late that the called the called

Incorporations

Hank S.R.P. Incorporator, Charters: Fore Small, 201 Chas. C. Lugger, [63] Orange et. Williamston,

Indian Goods

1 S D3 s S Done leithing Rome 22 50. Hiteling acrows 75s a sin buy brasis 5 50 1 other refers a sloper 10c Incliate Eath P2 Company 486 Corporate of Matrix S V

Information

At RATE opening information on any subject 48.
Not about ful employee Buryena, 1811 Whengold broading style! Hapital Michigan. Prohips service and effect on guarantees?

Inventions Wanted

Will I has appeared favoration. Write W. L. Renelle.

Laboratory and Chemical Services

All 1 Metals and Adapt with 400 life [11] IT becarie I greates 575 00. The Book is I server burgate to those of the State of the State

) track ("A a to the two to the best. Your eleva-ries provides and set and which the process furnished for the first test. W. Also man Minimards, I suresting ("house!" Box , 402. Resident Make

Languages

WORLD-ROMIC System Mantecher \$5000 long outer Princips 3, 94 (June French, Spanish Landbages, 5 West 50th New York

Letter Specialists

1 W RETT betters tokens booklets complete following token floris ers, mail certer dealers. I one signishe are to for details. I make it fill too million. Hors ford.

VIR Alle Phylics is not tacks for a copy of the Quel, to you take him Rule Folder. If contains some real (aspection) forth which tall processing on the prompts of a late tells after board on the Prompt between the the late to have to have a side three Wischelbert board and the late to have a side three Wischelbert board Advertisated Popular Copy Copy Copy of the C

Machine Tools

CANCERTY Building block Machine and Moles of a shade free a less a Manufacturing for 20° do Third a let 12004 510

Magic Tricks

é a congletan, give abrete quell trames. A gloque light of gran . Dept. a 0 Capit calc. Moss.

How R.A. Stage, My steries, Many Tricks, Novelties, stall still Free, Source Han ark P. storona

ANIASI as a No. is contracted. New Notice Proof and Table of the four Postspace the East Stongton Part of A Clark Stongton

Mailing Lists

MATTING Lists of stockholders—Investors In-dictions Suggest from for rises seed in abused retaries and individually deposited. Catalogue and in-formation on request. National Lies Co. 945 Broad St. National

Manufacturing

DEVELOPING ideas and monolistizing our operant; Absolute satisfaction IR years experience write as. The K & B. Ose & Specialty Co., 2016 Elm Pt., Ductionals, One, East. C.

Muscellaneous

ART photos 4, \$1.00, teason, \$1.00; enter \$1.50.

PORMS to cast head Soldiers, Inchana, Marines, Trap-pors, Antinaka, Inf. kinda Senii 190 tor Bus retesi Cala-lagus Benry C Schereke, 1034 72nd St. Hvooklyn, N. Y.

BEATT FT I discretive gifts for all occasions. Catalog feet Craim in Propt 1. Ear no Win.

"" I st at Humanuph Salas sig of Paristative lourpaste "bertal Horsocope and annu Adalysis need oldand by codate Prof. Holley, Nov. (20 realized, N. J.

AN O'L'D shares elect can be used in qualing a fine start rice wall clock. Disc provide and but the control of \$1. Write for particulars. After Dettes, Education for \$1. Write for particulars. New York.

MENT AN made plant but accept carridge belts, fases belts, fases belts, fases, butter har enriche, juggreen Leather a 110 Farmen, Historica, Texas.

HER E A bong mail quarrer value puts manne on hot. Edw Therefor they to district No. J.

Models and Model Supplies

HY LTT & CO ddS Jackson, Chicago, III Experi-mental Machinista Madel Mahera, 1966. Patterns, Complete greens Mach on shop

Motion Picture Business

MONTH Trian 000-mot reets \$2.50 such shipped big there on receipt of reed to see with order fode-product british 565 West compress than Authority, Trans. 64 N. 44 No. Machines, Lume in exceptionis filling, at the Engineer of a 1-25 M to

Motors, Engines and Machinery

M Profits New P 110 or 220 with 60 cycle Minche Phase to 120 his mi, is the fire 54, 1 345 fan 56 stail th here or Maries Make Worm that is a 12 has also stailed it a nation of a cattor Propen

Music and Musical Instruments

REN 1976 IN THE CHAPTER LATE PROPERTY AND MICH.

his ball to the last course concern acceptance and the cet pade access rejudding masses playing only the paid for Non-Crossive 40 and laws.

Office Devices

And it wister inartines and branch doubleature, fashers shork writers analors, if a sig machines an along tableath over Protes 147 S. Sanket M., Chicago M. (1914) In Reperson at the line of fasters, in the lands of the control of the lands of the control of the lands of the lan Ase New York

Optical Goods

ARTIFICIAL eyes Booklet free Deriver Optic too bares, betwee Asheroly,
Alli Albi-Little R. And today for a nopy of the
"Quite-Article Albi-pith And today for a nopy of the
"Quite-Article Albi-pith Early which will prove intercenting
and embalties of all II also right will prove intercenting
and embalties of all II also right belt prove intercenting
to palar Principle Month: Printiplety You dilet in
their models are a Address a six inguity, to Mannager,
Therefore Advertising Propoder research Manchile 25th
From the Act New York

Patent Attorneys

PATENTA Time evanue in applying for patenta. Dept that the last in motive ing pour lines for patenta. There is noticed to be a standard to be a substantial form of the last in the last i

Falls a Palose disclosing an invention that in-water should be elected, thoughters. Record of inven-tion. This should be algored as peaced and returned a in registre's a product of elected and description of the laws in feet the language and instructions. Our if we describe held free them and instructions. Our de facet. The to detain a fatent quotatus high in registred temporary parents. Legions of unsaled of let exist the most agent and others who are consisted by withing an remarding be provided to leading distriction choose palents were upon between See advis themselves home of Victor J. Evens in Co., With Ninta, Washing-lon, 13 f.

PATENTS trade that's topy ights. Primpt personal reliable service that 30 had active practice. Since to terms I had free Address P. G. Siggers, No. 1 N 1 Dubbless Machington, D 1

Part NTS Issuese five Elighest references Beat results. Principliness assured. Walnut; 2. Colonals, Paring Laurer, 660 O He see Washington. 3.1

13.1 1 3.7 1.8 1 cution tree on report, given sampling intermation and advice for all who have original (deas or improvements. Frank Ladermann, Registered Attorney and heat new Windowski Ulde. 1 New York "NPA I 1 11 toward has the noise I tell you have and bein you make the sale. Free particulars equipperadit. Write W. T. Greens, litt Jenther Residing, Washington 17 (

ATTLESON'S upont annually for ideas! Hundreds now matter I'm out you and profit! Write today for free hock tolk her to protect you sell, how to invest kinamated! How we bein you sell, etc. American Indea-tries, her., 502 Victor Bidg. Washington, 53. C.



Act Quickly to Get this Amazing Invention with Guarantee that I'll Keep You in Razor Blades for Life!

Final Opportunity To Secure Famous New Shaving Invention Backed By My Astonishing Written Guarantee To Keep You in Razor Blades For Life! It Offers You 365 Keen, Cool Shaves A Year-And No More Blades To Buy EVER! But Act At Once! Blade-bond Offer Expires At Midnight Dec. 31st And WILL NEVER BE MADE AGAIN! Write Today!

MY menantional introductory offer that I will guarantee (in writing) to keep any man in rezor blades for life is drawing to a elnes! Promptly on the stroke of midnight of the 31st, this iron-card blade-bond offer will pass into the annals of history. Nothing like it has ever appeared in the past Nothing like it can ever appear in the future! KRISS-KROSS the remarkable aventum that KRISS-RROSS the remarkable averture that makes my extraordistry guarances possible marks such an amount of the second second state of the second state of the second state of the second state of the second second

365 Shaves a Year From One Blade!

KRISS-KROSS employs the district stroke, same as a barton uses. Nower before has anyone captured the secret of suppressfully reproducing this stroke Maghet surky leasher grower' the trick in 11 seconds with a precision at takes a matter barber rears to at son. But that's not all killes KROSS embodies a ill another feature that has in north haffled mechanical reproduction is atrops from heavy to light Adjustable automatic by norther you when your blade in ready with the account out og odge steel enn take.

No wonder that this outer according the life of any make block using a secondic sugar f gradus, months and years. Think what it means? has more bother about remembering to buy new theses? To more raking such dellowes K1788-bit old coupled with my starting offer below out as your blade problem for all time. Know, tel stamouth sharps (never). And think of the ecupupayi

Semuational Offer

And now for my amashing offer! To introduce a tise-kitches stropper to those who have not get seen I. I am giving with it free a new kind of resort a 1h septembly resorbinated which completes the outfit which I guarantee to here you is faster blatter for life. Here show the plan with a 1 so the blades and keep renewing them with highlight with BANKE OF OPERS

If one of them give back on you for any reason been it rusting or making return them and [1] recondition of replace them with new ones

MYSTERY RAZOR FREE **TO EVERY USER**

blost astonishing rasor you ever eaw. Really I rators in one Adjustable to any sharing position. File of finger makes it straight or I shape in a life. Novel feeture to be a life. I shape in a jiffy Novel feature reduces beard resistance 45% and simply ap-through the toughest crop of whiskers. Nothing like it ever on the market before. Find out shout it tuday.

Sold Only Through Authorized Representatives

Wominster Lone Sift. K h I not K it to H throughput and flator in the cout holly box make on ideal know gift. Unique Atom gula | Bad different,

St. Louis

STROPPER

of Hage. No red tape. I give my amading guarantee in a sung. It is an amounted agreement to keep you. In survey blades for life?

Send Special Coupon Today!

Write at once for 15 opening on this automiching few averaged and find guarantee-offer is 1886-billiable to never sold a stores. I not deal direct with the or my authorized representative. Humaniter the the limit is drawing near Hend for empelote illustrated defaute without delay. No obligation, Just cup and man the couper to-day!

AGENTS:

Many Earn \$175 a Month

Make big money with KRISS KROSS! Free Make big money with KRISS KROSS! Free rater boosts sales armazingly II King made 356 one day E F K pary, Penn made 321 in 1 by hours. Others average \$36 to 566 a day Every duty buys on sight SPARE. TIME workers, OFFICE and FACTORY men make up to \$12 entra g day showing KRISS. EROSS to friends and fellow employee. S. Kannale made 11 54 entra worklind eventings. Kantala made \$154 entra working evenings 3 weeks. Get details at once. Chuck buttom of coupon and mail it tanight?

Without obligation provided interest appropriate for T. F.E.	D. Inc. Dept B-MI. St Louis, Me. phone send the full details of unions offer to keep but in Hance Apr. send the full description of tropper and FREE adjustable
Avise	
Address	

Check this appear is now one interested by making making on an ameliarized ERIFS-KARISS represent-

Petent Attorneys

but in a 1 Time of the right Problem Minimage of the Patrick against their such as I for should again the dis-tant P.S. . The cost of a 4 Hz. .

Fig. 19 and do not be really against themptone.

Phys. 19 form that to be been and consequence.

In any produced with the second to the first that the second to the first that the second to the seco

The transfer of Trade Marca Reportered to deposit on the control of the first of the first one of the first of the first one of the first of the fir

AT HE WAY THE WAY THE MANY THE RESIDENCE OF THE PROPERTY OF TH

in 16 and in this work Problem Sunter Witnessengton

4 in the Edward parent a substance of the contract of the cont the mate experience on an incident of the following from here to be made to be made

Principle Too Charles & Lover Parent F PR Stone

Party is the terms of the terms of the banking in the second of the second of

There are well through the Control Control Spring

be the section bear to be a few as the section of t

Pig 5 - gs as of the older pattern than the temperature of the state o proposed on management to be seen as a company of the company of t

Pasents for Sale

TANKS and promise accordance to the execution of The property o

Parents Wanted

BATTOWN CO. and Market and self-steam and self-stea

Photographs and Supplies

High Company regions of the track to the particle of our language and our language and our language and the second out of the second out o

the Art 1915 year will be housed on the first of market of the first o

which is a Representati on Borner Harriery Property or State & Committee of the State of the Sta

Printing and Engraving

THE PERSON OF THE PARTY AND THE PARTY OF THE As the proper speed were liber France, his First at La balls became a speed to be a liber france, his First at

to the STANDARD OF BOAT too on Brand or Franchisch

in the contract of the property of the propert

Multiplied of Monte of Attended

to a fill first on any a reason or to be for the first than the fi

It is not the property of the Philippe of the

Hate a Price and New York Special Property of the Price of the New York Special Property of the Price of the New American property of the New York Special Price of the New American price of the New York Special Price

Radio and Supplier

The is not a stational many with finders. But in the test and the book of many many many located and in the stational state of the stational state of the state o

Razors and Blades

MITTER To Raise Raws or A more mades. ID smite. Names of the State of

Real Estate-Orchards - Farm Lands

PT L'Extragge Ptg. mean N'm the caff Marchile in broken mean and are life quest detection desire a line reduction for W. Brand Man.

In we had up good favoring truck type positive to C 2 and input on the post of 2 and if govern year two Police of the police good to see a 10 person and 5 are post in the police of the

Selemen and Agents Wanted

to find the entering to take provide a transfer of the advanced for transfer of the advanced for transfer of the advanced for transfer of the advanced from the advanced for the advanced for the advanced from the advanced for the advanced from the

the lite of the lite of the state of the sta

of \$7 ma from no in the reason of \$10 particles, pure control and improved that \$10 per of the late of the tenton of the late of the late

a him to the the a more frameword because people for two distances with the property of the same people for all the two property appeals to the table to the same people to the same to the transfer.

I blid have a discipline interd. Bett mende approved people is a, or there has been also people that disclosing the first and or an allow the transfer of the feet people and the transfer of the feet people and the transfer of the feet people and the contract of the feet people and the

Review P and Reviewings dame. Halo Svi to del West of the No. 2 of rearythms. Emptelliment logs 36 dec to him a stage.

the trade ing out one plategy and when the to a negative for the country of the gard on the li-

A CARA Best teller den fliddet Result bei timp A think people to the door, ill also be Revente for Front of the second of the second

an age a we for the see and objection in one age to me for the see the form in-

Brits money and first called Burry arrests heavy gold the to have dong as the same of the same o

A property of the property of

To the second of the second of

to be the Marrie State to him Tool Marries of the State o

Beginning may as may be obligated origination a designation of the property of t t. No o stem Breeze habile men II 30 f

Prior of all an use is record to the principle was public to to active a native product. Within the bright production is only to the the state of th

to the statement of the

und genig det getter in deuen verfant bilg in neue finglieder eit eine Bertale genied it neue-die 120 laborere die Nome

The property of the control of the c

of the tipe that

of the property of the Park of the telephone

the set as the figure from F to the telephone

be also

A distribution that the transplant is a series of the second of the seco de la south

All all parties were as an Transportings against whether at mark the Parties of No. or No. or

phot to-duck the property of the law of the state of the point to-duck the property of the law of t

Selemen and Agents Wanted

TATES The People fact to expend people Atteber Distriction of the

ANY animomors and and cham? Morchants everywhere on merchiners, Promones sales them, why not year often deprivate the champer shakes of the champer shakes

p to give the p h. t. Hertandore three is no agentiable field three p ging national agents of our Histolike he are truck as no female a source or no many tage. The second interestinguishing Appointuit Speciality is a submit Ragion.

ACCENTA Sail attractively displayed had setting by candy specialties to stores—hig practs—Knatusive rights—Falestmanager Box 971 Richmond, Va.

Printed Paleston and the service of the first of the service of the servic

the fit of some P is articled that find remain Code that the final First sold definition and all fit from a fit of the first sold fit of the fit of the first sold fit of the fi

Billian or graph 45 a proper to free or every contract on the second of the second of

the part of the state of the st 3 for 66 4 wine on 5 full work to 1 full p Charles III

A TOP A AT THE REAL PROPERTY OF THE PARTY OF

From the part Pg products promproved to get the part Pg products proproved to the part Pg products proproved to the part Pg products proved the part Pg

ag a property of the property products proved the part

by all property of the property proved to the part

by all property of the property proved to the part

by all property of the property proved to the part

by all property of the property proved to the part

by all property of the property proved to the part

by all property of the property proved to the part

by all property of the property proved to the proved to the part

by all property of the property proved to the part

by all property of the property proved to the part

by all property of the property proved to the part

by all property of the part proved to the part

by all proved to the part proved to the part

by all proved to the part proved to the part

by all proved to the part proved to the part

by all proved to the part proved to the part

by all proved to the part proved to the part

by all proved to the part proved to the part

by all proved to the part proved to the part

by all proved to the part proved to the part proved to the part

by all proved to the part proved to the part

Ind S HE K and he is not become helper to be Fridge and he is not become the wilder gloring? and go for my help to

The second states the second s

MIN GIRL BY AN BY AND ENDED FOR BODGE OF the control of the contro

trafe Brill Tour true made Formulate Properties Ad the & More Cababay exception from

a Targe of product and department of the three same and department of the product and the product at the product at the product and the product at the produ

alitati da dan basar phasa man bing fielle ya Prasi y Bangair bras Brutarir Prasipitati a anan bi dan bark, di ngu

handweig Ang come W. a. Marth Cantrol the time is not be and it is not to the Principle of a second of the principle of the princ

the part of the wards the master of the source of the sour

n it many part on their growing to a service to a service to the s to \$ 5.7 m. Participant is been a manage. He is therefold depresented and their terms of the control of the con

effective to the transfer of the medical property of the state of the

NELL sharming Vantiles. Petrol & from the first the state of a second process of the sec

At I for the plant's person. Now occupy the fit part of the real to the state of th

Salennen and Agents Wanted

MARE \$100 weekly in source time. Sell what the public wants by distance calls remixing one. Two gales weakly pays \$100 profit. No big investment. So eminysping Sharpe of Colorado made \$555 in one multib Representatives wants it at once. This plan is averable, the country. Write taday before your country is gone. Colores, Inc., 43° N. La Salia, And L. Chicago.

ACENTS—69 50 weekly Introducing New 2 for 1 Induced Huntery for men. women, chibaron Silka, thise columns, 57 ctyles, 39 relices Samples furnishes. Space line will sin. Macachae Taxthe Company Cart 15211. Cincinnasa Oblo

NEW Pord shock absorbers retail at \$1.00-4075 From maniple of windshield anatitude Same-Vil to

HALEMATER We Pay You Well Hardensbett's famous flop of leastler rousle, diarine, calendars and other advantables should be Product of the years experience. Have sales advantage reasoners. Day communicate, Pariota offer for highling palescom. H. B. Hardensbett Ave. Lauden, N. J. Hardensbett Ave. Lauden, N. J.

HELL Apricially Hessian's Higgest His Easy to earn \$15 in single afternoon I verybod; buys. No competition Helling spirit himpaths: Write today for sporting special offer Apricially in Thamberisia, 8.7)

FREE shows for you Big attended commissions besides. Take union for men obtained a store and basiney 100 styles \$1.95 up—only losten by We deliver and collect. Appare up full time. Footby could, from Captio incr. Time 1.750 the Michigan, Chicage

A PATTH 335 daily Pass palier to competition Early sale helicle many reports, fermanest profitable limits, taken 2200 translaver features, taken 2200 translaver features, takense.

RATE pay to agence sulting M TitleR by DUARTH Flood and Houseloud Specialties and Funct Propositions Mother Propositions Mother Highward on first rongens, Strage BALESMEN Trussendium Repeater Used by Minnes. (20 profit on ten. 5) '9) makes Merchants repeat orders build you permanent huminess Auto things. Turritory Full or such line. Huminess marked pale Elser Products Deep Al-D Washington, D :

HALEHMEN, Distributors. We are placing proved office applicated him on the market cartenally at tractive apportunity open for representation. David Co., D Trainfelt S best backet

NIT ADVAITTIBLE And today for a copy of the "Guide-Arton Advantage Hase Fisher. It contains more resily important facts which will prove interesting hard valuable to yiel it sho will Have You at the Pupular Princes Alegarity Profit aboy. You'd had to him who plant by you'd had to him who should be the You'd had to him to have the provinces of the provinces o

Cleanified Advertising, Popular Summing blantinly 200 Projects Avenue, New York

1 5 10 4 3,7 - Paid in advance. From Plicker reduced for your two Amanging carsings categorizing them agregation for your all and a first and arranged and summer the projection of the African Superior, they are all first and a first projection makes a larger than a first form, I apartical than a first projection makes a larger form, thought summer and summer of the first project of his first project and first and your profess of its down, asked with the project of the first project of the first project of the summer of the first project of the summer of the first project of the reads now got your above to the first project of the reads now got your alternoon the first project of the first project

Newtick, and Bernet term Mose.

(Newtick, and Bernet term Mose.

(Newtick B accepted termination closes ealed to 4 out of 5 principates. Amending new devices. Histophine everything. Over 190 the last the west being a last to because Missipe, etc. Make now making \$1 to \$0 an holes. Which he petalle and I risk out it affect Cape teal teal teals and Newton and Time. Hand make, address. Not being Common to Martin. But, 324 East Ave. Sin Bookel. Common to Martin. But, 324 East Ave. Sin Bookel. Common to Martin. But, 324 East Ave. Sin Bookel. A 1-N "He wanted to distribute samples, his mosely have method, write quick P. B. Vann, her J. Ota. 11

New York

A JEN Pet Make \$500 dil before X mas Pay dally.

No investment Rimoniano antical Burkles and noveltion Big Nova and all was selle a Particular territory.

Lincol No vity in 600 blue I dahed, injungs.

A JENTES wanted 20 shares 3 dil. New Liquid
dilminates rater. Yours for the price. Byten Laboratories, 2701 South Habited St., infrage.

ONE STATES I Sentence and the infrage.

WANTED Representatives to every helpry is the other fivation Popular Science Manthly, 150 Fourth Detter Halm

LANVARSHIP street been accepte. Day our ab-golds acceptably for he said for his hearthcale must buy We undersell them all Hundreds of other heart Sout the for seven different amples of acades from Mills Subject of 13 Faut 18th Pt., New York Phy

PR FITH 100% selling quality suppressived perfumes that tollet preparations last produce permatent repeat gales. Liberal free while Lebiase Perfume Co., \$330 Cheroit Ave., Chicago, II, Tept 79

Cherroll Ave. Chica et. II. Thept 79

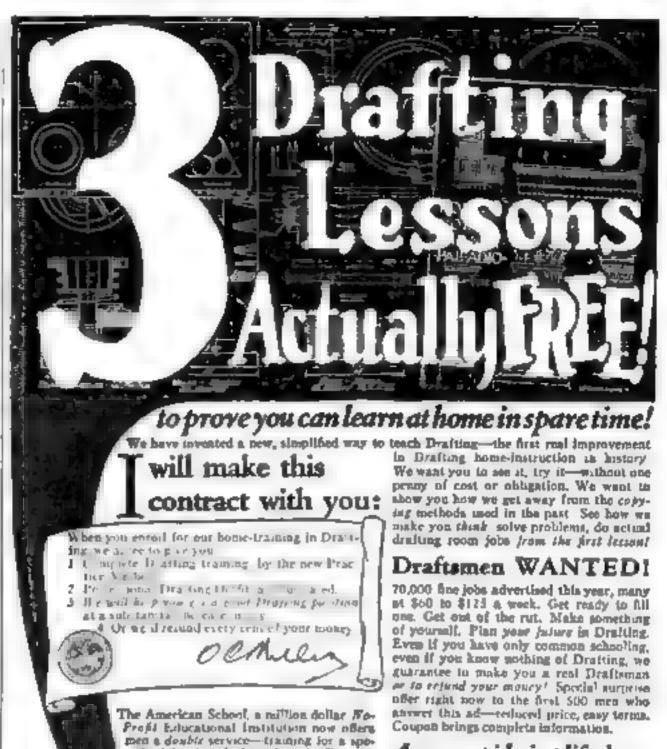
AGENTA for well known automobilis polish. Inthe part time basis. Experience not appearancy. Ambitudus note, willing to work can make real money of this proposition. Sign commission allowed. A real oppuratual v for the right man. Barthel Laboratorius. \$350 Websiter Ave. N. V.

AGENTS. this is very apportunity, mither appearance.

AGENTS. this is very apportunity, mither appearance.

ACRNTS, this is your apportunity rubber special-ties, dresses, underpartments, simpling apparel, combined for big saraings. Dept. 273, B. & O. Mig. Co., Pitte-bursh, Pa.

RALESMEN to sell all wood, hand tailored, make to measure, sub a sed invercents \$15.50. Commission \$7.50, large line 600 subspic swetches, easy to sell. Write for wing plan. Heigi Tulbring Computer, Department 7 615 W Baltimore Street Baltimore, Md.



A new, rapid, simplified way This new "Job-Method" gives you netural

drafting-room john in a new one-strp-qt-atime way With pictures which you can understand almost without reading the "lessons " And that is why Assertes Schooltrained Draftsmen can qualify for a good job at big pay when they graduate.

HIGHWAYS TO SUCCESS! The big money is Drafting goes to men who specialise In Machine Design, or Electrical Drafting, or Architectural Drafting, or Structural, or Automotive 11 an't

enough merely to know general Drafting practice You next know how to calculate and devices and plan original work,

You need many Engineering subjects to fill the kittle of a Drafting position that pays \$60 to \$125 a week The Amer-Jean School new tacludes this specialited framing en ilt

Professional

Outfit Given

Fine ampor ed to

Desiting course.

الهاء

W ELD n. sulen a

Job Service Free to Students

SCHOOL BOW Offers and Graduates: its students and graduates, without cost, the

services of an efficient Employment Department which keeps in touch with the employers of Draftsmen all over the United States. We have placed hundreds of men in good Drafting positions. We have made this traiting so complete, so practical, to easy to master that our students are bound to make

good And, so, because the demand for real Draftsmen continues to excred the supply and because this training actually prepares men for good t Drakting positions, we back it with a Free Employment Service, free to employers, sindenis, graduates.

cific job, then finding the job. For one

small price, on terms of only \$5 a month,

you are now assured of definite benefits,

Coupon brings complete

details of this

sensational offer?

both in position and salary,

Chief Drafting Engineer

American School Dept. D-876 Charge, Il.

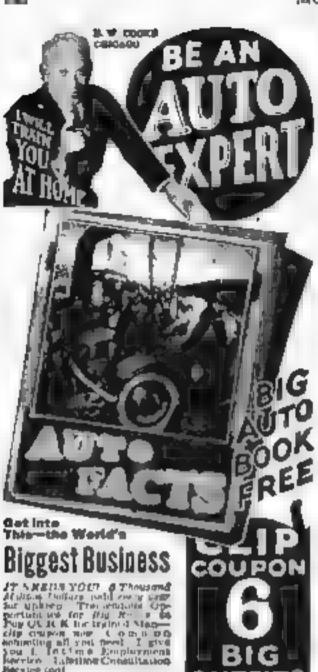
COUPON Brings 3 Lessons Free

Get them. Test your own ability to learn Drafting and get ready for a line job and hig pay. Coupon also brings surprise offer and complete information about your opportunities for success to Draft-MAIL IT TODAY!

F	
ı	Chief Orafling Engineer
	AMERICAN SCHOOL
١	Dresel Ave. & Sifth St., Unlang
h	Rush 5 Pree Drubbing Lemma
L	forbusting, money back
ì	can benitte a real Draftman a
8	home to spare time.

į	Mann	MANAGERITER	
i	Steat No.		

. Brake



Necytee cool J'il Train You AT HOME

Get my Free Basic Find non-have yed and because a say Tr y man's strictly also quick fined Kreen you'r promise to the Basy house. Yet that I have to leave you'r describe, Master array litabeth of Alito Wank right on your such house Basic, as nothing you will be a Basic, as nothing the will be a Basic, as nothing the will be a garrantee of the and up to 110 Mills and up to 1 Mills and up to 110 Mills and up to 1 Mills and up to 110 Mills and up to 1 Mills and up to 110 Mills and up to 1 Mills and

Make Money QUICK Special for their nemaring of specificants explain \$1.700. See hour inscription of receive duril theretains played desirement analysis of their critical depondence among their marking believed depondence and their sees of their select depondence and their particular of their select depondence of their particular of their select depondence of their select and their select depondence of their select and their select with mark took and other select with their selections of their selec

Megasine - all fif E of Error Charge. B. W. COOKE, Directing Engineer, Chicago Mater Training Corporation Dopt. 325 1914 Sunnyaids Ave., CHICAGO

OB-WA

D. W COORS Directing Engineer
Chicago Mutor Ten aing Compatention, Dogs. 825
1916 Survive de Ave. Chicago 16
Red on FFEE Acts Rush and proof that min bytains of demo finpert of home in parts from Alexandry and Survive Chicago in the
invested that this engineer no in seven.

Name A SHOWING

BIG

OUTFITS

Tools, Tool Bag, Fortuble Electrical Test Bench, Radio Receiving Ser, 103 Waring Disagram Charia, Ignillon and Sichet Wrens h.

Sets, and Tice Repair Outht

Teachers, authors, students and all who wish a broader outlook may start any day courses in Psychology, Art, Government, Economics, History, Literature, Education, Religion, Foreign Languages, Sciences and other subjects. These courses yield credit toward a Bachelor degree.

The Umbersity of Chicago

Chicago, Illinois 139 20to Platt

Schools

Stant. 375 to \$250 weekly Motion Picture. Portrait and tomorrow Photography some Proc Photography Special state with New York Lastitus of Photography Legs 5A GW 1277 St. New York

Shop Equipment

DEALERS Buy Batters they Equipment and Peoples at Wholesain, Sattery (Barger \$52.00 Adams-Bars of columbes this

Stammering

of Tilly 1 7 M No. and starragering cured at home limit with a social of few Marry Nothernoods, 50 A radio, 125 cars to a symper thirage the

Stamps and Cours

P o spend of amp o Tolento when approvale look by however, total halfs to the

Janua by shortween, the tark the three time and a people of the tark and a people of the tark at the tark and a people of the tark at the tark at the tark at the tark at tark a tark at tark

e Anter our pro-train on a constitut flus-trained affect over hing present by your sets photons with much consen. From Phillips, New 1912 [Cortinos.

e AMPH to here are at Albruro Supuliparane tome.

could be go has not one or attorney of cutan for only from a analysis questing to the last first only little on William Remarks, will I remove it root literates.

HART Works, Black Society, Humbs and Dechies in 100 Starks and price fat the Cop Data C Starks for the Page 100 Data C Star

till a sa senare Aprelsasph to applywhi supplication of Startments in the Police Last Sc Pennsylvania. Startment of Police Last Sc Pennsylvania. Startment and Startment a

that are a set of the party of the contract of

be also be attached and reason. Mustimate Metabership Trial parabetal price 2000 to an atomica
for a playe to the March H. A Marchedo Marcha
for Parability and approximate the Approx at Ap. I
ments. Read Trial material for Madding Vertical Students
the proximate Manual Trial Control of the Manual Students
the proximate Manual Trial Control of the Manual Students
the proximate Manual Trial Control of the Manual Students
the proximate Manual Trial Control of the Manual Students
the proximate Manual Trial Control of the Manual Students
the proximate Manual Students
the p

NAME of put to a on and Protects I make because and sold Proper surregions Ad II am described which and one again 400 personal bears with 10 county along before the surregion to the sold of the surregion to the surregion to

polic, derect to a up, I skinder

of ANP packet or an Approval Applicants. Hereby
Teople, spentur Indiana.

I d. at all most on approval most me post
was due and reference. M Irana, Box 836, New
Kein glob Pa.

Technical Schools

fill of the Testicital I discretifies allow layer prior in a course to their ing and I represented in mechanical electrical of the right result in the right prior in the second of the right in a received Plan Breading, etc. a special little to your section. On their wasterd limit prior in after control of adults restricted to your section for the second of the malactics. This method is adult to the section for the part free method and the algorithm. I as held in recting analysis for part free part of the first testing from the section of the first testing from the section of the first testing free every direction. The section of the first testing free every direction of the first testing from the first testing of the section of the first testing from the first testing of the section of the section of the first testing of the section of the section of the first testing of the section of the

Telegraphy

The HAPPIV Dor't blurge and Wireless aught thoroughly and quickly. There's close decaded this against Windowski, oppositus of Fit makes his time of the other pix t. Not not come that the other pix t. Not not come t. Not not com

Typewriters and Supplies

TYPE WHITE he all outer lowest priors a year surrange send for the raced catalogue littery and send of Y

The state of the s

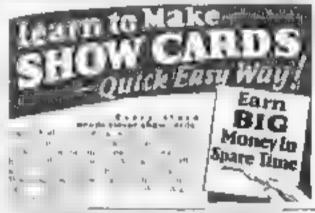
Wanted

DETECTIVES meeted everywhere Expenses the accessary Fartendars from Will Confe Walter former Servenment Selective, 1968P Republic. Y

WANTEL samples of novelties, new household as-ticles and in exclusion, chesis. Write Cheekley Novelty Co. 236 Broadway New York.

WANTED Representatives in recey factory in the United States. Popular frames Monthly. 256 Fourth Are. New York.









BECOME AN EXPERT

time A connects und? P. A a correct to the color performed by the color of the colo LaSalle Extension University, Dept 1 84-21 Chicago

Latest Planes Herald New Era of Safety

(Continued from page 21)

coming to rest on a hillside three miles from the starting point. Oelse climbed out unscathed, and the machine suffered only slight damage to the landing gear

and a propeller blade.

The development of big commercial air liners for passengers and freight has resulted in an entirely different sort of safeguard—the use of multiple engines to prevent the chance of losing flying speed near the ground. Machines of this type are the big triple-engined Fokker monoplane in which Commander Byrd flew to the North Pole, the new Sikonsky biplane built for the New York-to-Paris hop, and the Stout metal monoplanes which the Ford plant is turning out for the commercial market.

EACH of these machines is driven by three powerful motors. Apparently designors do not intend to stop with three, however. In Europe Louis Blerot, with hat new confidence in airplanes, has just completed plans for a trans-Attache areliner with four engines, to carry thirty passengers at a speed of 125 mills an hour Dr. Rumpler, one of the foremost German experts, has gone him one better by planrong a ten-engine machine for \$6-hour. passenger service between Hamburg and New York. Thu monster would carry 1 in passengers.

bome of the advantages of multiple motors were explained by Edsel Ford recently when he discussed with President. Coolinge the future of air transportation and the pians of his company to supply

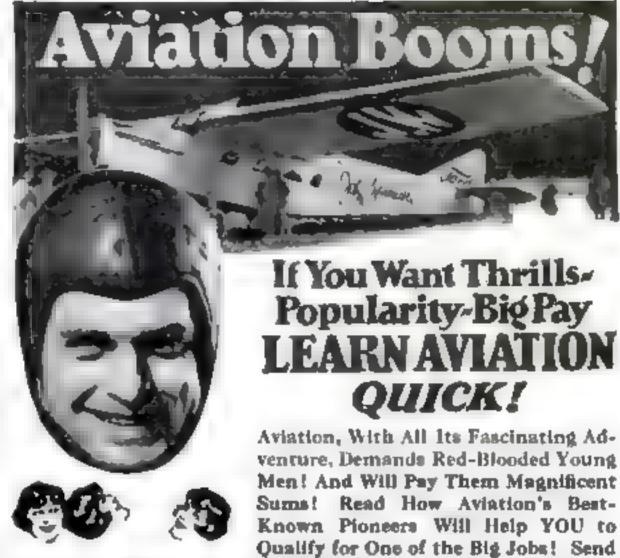
airplanes in increasing quantities. "All three motors are put to work when the load as lifted," he said, "but in transportation they are throttled down. If one motor goes out, the two others are mercased to full speed. If two go out, the remaining one gives the plane a broad. field for a forced landing—a ten-mile radius for every thousand feet of altitude. For a plane five thousand feet in the air, this means a fifty-mile radius for landing.

WITH such a reserve of power there seems little to be feared by passengers. Pilot and passengers can suit through the air with confidence; in all events their ship will remain under control.

Planes such as these, of course, are designed primarily as commercial curriers. and are out of the question for popular use. They require spacious landing fields. And their cost is probibitive except. to commercial organisations and wealthy individuals. The Sikorsky plane cost something like \$40,000.

The price of the latest Ford monoplane is \$37,000, with the promise that after the first 100 machines are sold it may, however, drop to \$28,000. At the time of his conference with the President, Edsel. Ford declared that eventually "we hope to put a machine in the air that will be proportionately as cheap as our pleasure Chrs."

A few days after this declaration, Henry Ford celebrated his aixty-third birthday by exhibiting his (Continued on page 144)



Today for Your Copy of Our FREE Illustrated Book, Listing and Describing Positions That Pay \$4,000 to \$10,000 a Year!

PREPARE

For One of these

POSITIONS

AVIATION, the most thrilling of all 20th century professions, is growing so swaftly that one can hardly keep track of all the astonishing new developments. Air-mail routes have just

been extended to form a vant aerad network over the entire U. S. Air-bies and airplane factories are apringing up all over the country. Men like Henry Ford are investing Milhons in the future of commercial Aeronauties in America! The possibilition are so tremendous that they stagger imagnation!

Everything is set for the greatest boom in history The fortunes that came out of the automobile industry and out of motion pactures will be nothing

Accommendate Epitrocrist
540 in \$150 per more
640 in \$150 per more
650 in \$150 per more
650 in \$150 per more
Accomment of Contractor
Erroristant Permit page
860 in \$75 per more
Accoptant Repair page
860 in \$75 per more
660 in \$75 per more
560 in \$75 per more
560 in \$75 per more
650 in \$60 per more
655 in \$750 per more
675 in \$200 per more compared to the fortunes that will come out of Aviation! There is just one thing holding it up lack of trained men! Even in the beginning thousands will be needed-and generously paid. The opportunities open to them cannot be over-estimated. Those who qualify quickly will bod themselves on the road to undreamed of moneysuccess—popularity—and prom-

Start by Becoming an Aviation Export This Easy Way

Think what Aviation offers you. Thrills such as you never had before! The praise and plaudits of the multitude. Ordinary eslaries from \$75 to better than \$400 a week! And a chance to get in on the ground floor where rewards will be unlimited!

Get into this thrilling profession at once white the field is new and incrowded. Now-by a unique new plan--you can quickly secure the bane training for one of these wonderful

> high sularied jobs, at home, tii spare time. Experts will teach you the secrets-give you all the inside facts that are essential to your mircess. And, better yet, the study of Aviation is almost as fascinating as the actual work itself. Every Lesson is chock full of interest and so absorbing that you actually forget you are studying. But best of all are the ultimate rewards you are fitting yourself to

Send for FREE Book

Bend the coupon for our new, fras book, just out—"Important use in the Airplant Industry." It is vitally success up, reads like a remance and talls you through about this automobing preference

you never even dreamed of.
The cook p or lappying it could easy yet for a dollar.
We offer a line of number FREE. Write for yours to-

AMERICAN SCHOOL OF AVIATION

Deet, 1368.

3601 Michigan Ave., Chicago, Ill.

American School of Aviation, Dege 1346, 3445 Michigan Ave., Chicuse Illenois

Without any obligation please send me PREE book 's open animal in the A rolang Industry " Also information about your course in Practical ARTHOUGHLESS.

Name

Address

City

Have You These Symptoms of Nerve Exhaustion?

DO you get ex-Do you become fatigued after slight exertion? Are your hands and feet now Do you suffer from const.pation or stomach trosble? In your sleep meturbed by troubled dreama? Have your spe le



of irritability? Are you often gloomy and pessimustis? Do you suffer from heart palmintion, cold sweats, ringing in the cars, duxy spells?

These are only a few of the signs of woak, unhealthy perves that are steadily robbing thousands of people of their youth and lealth.

What Causes Sick Nerves?

In women this is largely due to overactive emutions, and to the constant turmod in their domestic and marital relations. In men, these eight of nerve exhaustion are produced as a result of worries, intense concentration, excesses and vices. The mad pace at which we are treveling is wrecking the entire Nervous Organisa tion

Nerve Exhaustion is not a mainly that comes on suddenly. In fact, it is a very gradual development that deceives scores of men and women who appear to be in the best of health. You all the time their nerves are in constant state of upheaval, slawly undermining their entire organism.

How To Strengthen Them

No tonis of magic system of survives can ever restore the health and vigor to week, etch, an-basered nerves. To regenerate bust nerve force. bannered nerves. To represent a suit nerves in the property of the action and dispose if nerves it nerves in the particle and the property of the particle and the particle and the property of the particle and per entire and per ent tions rate by over troops

Read This Book

Rand upon many years of intensive expeliences and study, the farmous Norve Specialist the times Displays have been accurate to the transition of the Norve Serves for the In plant tanguage be given section easy-to-follow rules that have repeated thousands of more and which to regain that have nervous energy and to acquire glowing breath and youthful vitality. It makes you to correctly dangnone your nets case and shows you how to bring

back your met nervous stan y New Nerves for Old to worth the weight in gold and yet als coul is order like ethrope of a book will prove a revelation to you. It will bein you throughout your en re ple at wall belo you on for yourself a solid foundation for your ful are noncome and happiness. Mail course for your copy to-day Address Richard Blackstons. 6311 Flot from Building. New York

RICHARD BLACKSTONE. 4311 Platicon Bidg., New York City

Picase send me a copy of your book, "New Nerven for Old." I am enclosing 25c in coin or stempe

State

Address

Otto

Latest Planes Herald New Era of Safety

(Continued from page 143)

long-looked for "sky flivver " the secrets of which had been guarded for months This little monophase, weighing only 350 pounds, is one of the smallest single senters ever built. Its wings measure only twenty-two feet across, and its fuselage is only fifteen feet long.

"At present the plane should be regarded entirely as experimental," said Mr. Ford. The experiment, however, gives testimony that the flying car for the man of small means is more than a dream.

"OR one thing the little plane has a new arrangement of dapa to give it quick upward lift from a small space. In one demonstration, when the machine was started at the rear end of the hangar, by the time it left the hungar entrance it was sailing through the air. Later, observers watched it spin down a country road bke an automobile, the tail skid having been replaced by a wheel, thus demonstrating how easily the owner of such a machine could drive it from his bome to any open place for the take-off

At present the "flivver" is driven at a speed of 100 miles an hour by a threecylinder air-cooled motor. This will be replaced, it is said, by a two-cylinder engine which will reduce the weight of the

machine to \$10 pounds.

Still another solution of the small plane problem is offered by a novel plane with folding wings recently perfected by Attred A. Verville of Chicago, designer of winning muchines in the 1990 and 1974 Pubtaer air races. From a spread of about thirty-five feet the wings can be confined to a width of twelve feet. This makes it possible to house the plane in a shed only twenty-five feet long, fourteen feet wide and nine feet high. Moreover, in case of forced landing in a field too small for a safe take-off, the polet can fold down the wings, hail a passing motorist, and be towed to a larger field. The transformstion takes about Biteen minutes.

IMPORTANT, too, is the recent appoundement by the trusteer of the \$2,500,000 Fund for the Promotion of Aeronauties, established by Daniel Guggenheim, that benceforth the fund will be devoted primarily to the promotion of safety in flying. At this writing rules are being prepared for an aviation safety contest, in which inventors offering the most promising ideas for making flying safer will be endowed with funds to carry on their experiments

To the same end the fund already has made pomple the establishment of schools of aeronautics in New York University, Leland Stanford Interestly, and the Caldornia Institute of Technology

How soon we shall fly our own maclupes depends, experts agree, on how quickly footproof machines can capture public confidence. Once that confidence has been gained and public demand created, quantity production and lower prices will be possible. The wonderful history of the automobile will be repeated in the air.



Comm to mount all blode of game, block automate fight of facts make rage, release of You state from layers that to absuring and in pour west become disting your and these. The trusped any interesting and easy to gasterate Great sport and into of face. Big metery for poor apare to

Mount Your Own Specimens

Decumin your brains with become ful specimens that you he re margint and mounted yourself. You can make his money thing the work for others blancape, mere and betterining very pare analyzed for high prime. The 100 minutes with me 10-byte doing the strong of the brain with meaning with the strong of the brain of the strong of the strong



For every ten gallant you buy you are many five. You are go ting just half the power half the miles age to a shrutal top of your quantities. For your up attending new it was one a redecounter simple little de tor makes on a really any car give twice the regular malesge many go T* to T* and even the major on a gallant. and is a Bing a wend a sample at los rich. Write to J. A. Stranish, P. M. Stranish, India, Pulsania, S. H.

Mr. Brush Salesman

to cell an old occapillabed high-grade guarantees. Instead the course of the state of the

WIRE GRIP SANITARY BRUSH CORP.





Veti can be quite y carrel of you of archiver. Hend if you of archiver thend if you of archiver thend if you of a page to a landing brack to be at a page to a landing brack to be at a page to a fact the bare. It was a page to a land to be a page to a page

AKE MONEY EVENINGS

Let me show you how 6364 men without ex-perience are fidding from \$25 to \$75 to their abcome each week without giving up their present position. Sell the fairest selling article today-radio. Demonstrate evenings. Five tube inetruments in few in \$25 and but communion in you Endance territory to right men. Write lodgy for 96 page book which tells how 4364 men have done it. Don't delay territory going fast.

Chief Engineer Duraing, Electrical Districts

American School Bage Elife Dramit Ave.

Will 1927 Be a Year Without a Summer?

(Cantinued from page \$4)

years, making reports on the sun's radiation. All these reports are to be compared over a series of years, and, if they are similar they will form an important basis for the work of those seeking a scientific system of long-range weather forecasting.

The U.S. Weather Bureau up to now has regarded the difficulties in the way of accurate measurement of solar radiation as too great to warrant the adoption of a new system of long-range weather forecast ng.

"The weather bureau prises the confidence of the public," writes Charles F Marvin, its chief, "and will continue to insist upon direct accentific evidence as the only legitimate basis for adopting a new system of forecasts, especially for months, seasons and years about. The public, especially awaiting the advent of long-distance forecasting, may rest assured that the bureau is disgently searching for a sound basis for such forecasting."

N THE rate of the scientists asserting that the ann's radiation does vary. Units making possible long-range weather prognostication, is H. H. Clayton of the Smithsonian fratitution, "An increase in the ann's radiation brings a rise in temperature and a full in air pressure in the equatorial regions," declares Mr. Clayton. "That is unmentately followed by a rise of pressure and a fall of temperature in the temperate regions, resulting in a chilly spell," When he was head of the Argentine Weather Bureau he made forecasts for a week in advance, from observations of the sun. They are saxi to have had an accuracy of eighty percent.

Mr. Clayton's reports corroborate those made thus far to the Smithsonian Institution by Dr. Abbot, who also is convinced that weather forecasting can and should be made from observations of solar

mdishon.

"THERE has to be an immense task over the world and for all seasons of many years with recorded solar changes, before meteorologists will be in shape to begin predicting from the state of the sun's heat." writes Dr. Abbot. "This great work is only begun. The ground work is still to be laid by a tremendous amount of tabulating, and then the new method must be tested to see if it is sound, before the official weather service is justified in adopting it.

"Meanwhile, doubtless, the free-lances will be taking short cuts as they have been doing at all times. Sometimes they are right in an impressive way, and when they are, their failures are apt to be for-

gotten.'

Just how the assumed changes in the sun's heat affect our climate is a question that has not yet been solved. The most striking theory is offered by the meteorologist, Herbert Janvin Browne.

Browne believes that several years of a high solar constant will so after the temperature of the ocean currents in the Atlantic and (Continued on page 146)



Street No.



Former Bricklayer Now Earning \$12,000 a Year

"When I enrolled with the international Correspondence Schools, I was a brick-layer and I didn't know a thing about blusprints. Taday I have my own contracting business and I am able to figure the most difficult jake and exercise them to the satisfaction of everyone concerned. My income je between \$12,000 and \$15,000 a year. It containly was a lucky day for me when I sent in that I. C. B. coupen."

That's a true story of what just one student of the Intronscional Currepositence Schools has done. There are thousands of others. Every mall brings letters from men and women telling of in research in income and salary due directly to space-time study

One hour a day spent with the J C 5. in the quiet of your own home, will perpute you for eaccome in the work you like best
Mail the soupen for Free Beaking

- TEAR OUT HERE - -INTERNATIONAL CORRESPONDENCE SCHOOLS

Han 7622-E Amanten, Pappa Oldage and formed overappendence others to the storid Explain, w divide off he on me. how I can quar to better pool on, or an the publish, before which I mark E.

Plunge.

Restant, we distall still the publish. Inform which is an any stands for the publish. Information of the publish is the publish of the publish is the publish of the publis

Comparint Bus notes A. Employer Address. Birest and No. Panadiene now send this preprint to Informational Corte-spondance Schools Counties, Lieutek, Manifold, Counties



It is not too late to acquire Pitch is quol Training Laura by question and Americ method at home is spare time, as actorishingly low cost. Transpling bailed down, no long dry means, no lessons to prepare. Subjects fortiode literary language sciences. America. Earlish, Economics in the in thubsands of High Schools. Govir lighter show Tigh Schools. Govir lighter show Tigh School. Training increases excaling Wirefor payteulars MICH SCHOOL HOME ETHON BUREAU. Il Union Square, Durist, Non-Yerk

Will 1927 Be a Year Without a Summer?

(Continued from page 146):

Pacific that the chinate on the continents may be affected. That is, the oceans would become great storehouses of heat and, by warm currents such as the Gulf Stream, would distribute this accumulated heat over the land even long after the high solar constant causing this heat had been

In other words, according to this theory, a bot sun over a number of years may form the bases for forecasts of a hotterthan-usual summer in our temperate zone for a certain year. Browne says that 1927 will have an unusually cold number because the solar constant has been decreasing steadily the last few years.

QIR GILBERT WALKER, perhaps the areatest of all the weather men, also bebever we may have long-range forecasting some day. His opinion follows:

"The large variations of seasonal rainfall, pressure and temperature are, in general, linked with variations in other parts of the earth, so there is every cause for hapefulness resarding the possibility of understanding and predicting them: but many researches needing time and money are necessary, and it is highly descrable that as little as possible should he done by carelem work to diminish public confidence in the possibilities of ong-range forecastang,"

Weather dominates everything. Agriculture is wholly at its mercy, and upon the ancess of agriculture is based nearly all our social and economic progress. When agriculture fade, everything falls with it. No wonder then, that science is devoting more attention to the problems of weather.

It is impossible to calculate the value to the world of long-distance forecasting. It would save millions of lives and billions of dollars each year. Crop fadures from drought or excessive rainfall rould be largely prevented by the planting of such crops as would mature in the kind of weather predicted. Floods could not be prevented, perhaps, but with five mouths' warming preparations could be made to meet with conditions expected in threatened areas. With nearly all the element of chance removed from farming, suriculture would be fairly stabilized, and all the business of manufacturing, destributing and selling would readjust steelf on this stabilization. Hard tupes would never be as hard again.

"HE Umted States, because of the importance of its agriculture, in, of all nations, perhaps the most interested in the study of causes of the weather. It st only natural that more of its scientists should be acarelung for knowledge far afield. If it can be done, their ability and earnestness will tear away much of the veil of mystery enshrouding the greatest influence in our lives—the weather. Success will bring long-distance forecasting, a thing man but always wanted and which some men have thought they had. It would rank as the most useful achievement of mankind.





 thru the only school operated as a department of a large art organism. tion. Commercial Arthur to high the "Meyer Both Way carn to high the Kin one ner year. We today have es \$10,000 per year. We today have hundreds of students who had previously studied in other art schools, Why? Recause your Instruction to bond upon our everyday reperi-ence in meeting the art needs of leading advertisers. Home study instruction. Write for illustrated book telling of the success of our nd radions Lts.

MEYER BOTH COMPANY Michigan Ave. at 20th St.: Dopt. 15 Chicago, III.



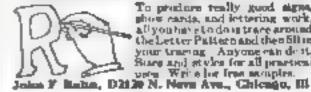


AGENTS 500% PROFIT GENUINE GOLD LEAF LETTERS.

Guaranteed to never tarnish. Anyone can put them can stures and office windows, Energy demand in percentage from Clork anys entitled day \$22.70. P. L. Reel made \$9.00 is two minutes. Write today for free pample and liberal offer to general apents.

METALLIC LETTER CO., 414 R. Cirk Book China.

SIGNS and SHOW CARD PAINTING MADE EASY



To predure really good signs, show cards, and lettering work the Letter Pattern and then 511 in your training. Anyone can de it. Such and styles for all practical

America's First Great Experimenter

(Continued from page 28)

another. These two long wares arould give the force of all the plates of glass at once through the body of any animal in circost with them.

THE plates could also be discharged sep-arately, or in any number at a time. And the only difficulty with the battery seems to have been in charging it. Franklin succeeded in killing small unimals, knocking down men, and generally demonstrating its enormous possibilities. Nowadays, of course, it is hard to apprerists what progress in electrical knowledge is represented by Franklin's work. Everyone runs his car with a battery or. at least, uses one to ring his door bell.

At about this mine period kinnersley, with Frank in helping constructed the earliest electric motor. A circular sheet of glass, conted on both sides, was privated to turn horizontally, in such a way that its coatings alternately communicated with bullets, fixed at equal distances on the circumference. Fixed near the disk, glass supports carried brass thambles, near which the bullets passed as they were carried around. The wheel having been charged, the bullets were alternately attracted and repelied by the thimbles. reported that this contrivance ran for asmuch as half an hour making twenty revolutions a minute. When kinnerdey had connected it so that it would ring chimes, it became the first motor in electrical history to do any inseful work. It is not much wonder that Frank in was inspired to press forward his experiments.

STILL, he found time for other scientific interests. He could, for example, ducus earthquakes, of which he had a theory of hu own. In advancing possible causes, he proposed that the earth might be the cause of its own shaking, due to a large mass of it being dislodged or dissolved by a fluid halden under it. When anch a mass began to sank there must, he and, be tremora. Or another cause might be the underground waters which, from confined spaces, might overflow to cut new courses and, becoming hot, enut fumes and blasts which would result in "great succusions." Yet a third cause be proposed was sir, pent up underground. Eventually, this must burst out and shake the earth. Lastly, he suggested hidden fire, an producing sulphur, bitumen, and the like, finally bursting into flame in a close space and keeping up the earthquake until it found an escape through a volcano. Accordingly, he drew up a preliminary theory that the material cause of thunder, aghtning and carthquakes might be identical—"the inflammable breath of the pyrites, a sul-phureous substance." From thus, of course, he was later to depart widely. In the meantime, he suggested an experiment to produce an artificial earthquake by mixing iron filings and sulphur together in a wet pasts, burying them half a dosen feet under ground and, at the end of ax or seven hours, watching them explode. (Continued on page 148)





DON'T care what you are now or what you think, The American of which I am premient my take you in shirt cars where and help make a Master Salesment of you put he in the same class with the big my men who have all the good things of life and have thought that Salesmen were been

trol that blea has kept many men from succeeding Hat this Association of Salesmanship expects one principles that any man can be laugh) the rules and principles that make men Minster Salesmen.

Easy as ABC

can a or 49 350 supremen from the biggest sales or-

point for thousands of men who are now supposes of

nelsomen This book Minlers Nelsomanshy.

The book you we here has been the starting

If you have ordinary intelligence you as quickly master the minute A 15% and mining. There are cretain as a of approaching a prospect to get his included attention.

perform when to altimulate been into ret

cectain ways to overcome objection be ter down propulates outsut com-pet tion and note the prospect set

I to esta learn these principles at being in a short period of pleasant (neutring study. And mee you have mosts of these see etc.of Master.

Silvenianship you can take advan-

of the Association nethout charge

This is a true inper-tubility for during

genrantions in Attorney

now FREE, and will be sent to every man who fills out and exturns the coupon below

Rush the Coupon

If I were asking arroral delians for this book you suight healtate. But I am not. It is Free. And since it may mean the turning point to your life, it per tainly to worth the two cents you will have to spend to get this atmating book and read for yourself the naturally long furth given between its two contents. You have averything to gain so that the contents to make the part to the two contents.

not one orat to first, so shall the coupon today sure.

JATIONAL SALESMEN'C

State

Chicago, Plincia

National Salesmon a Tra mind Ass a.

Pept S 15, N S. T. A. Bress, Ass. a.

Chicago, Plincia Notional Salesmon a Tra mind Ass p. Rept S 19, N S. T A. Bidd., Chiroga. Elitosis

Fersi are \$3.2.1 year book "Modern Salesmanship" and proof that I can become a Max or Halesman,

Kame Address 1 dty

Age

Overspatter.

Read interesting article on Page 4, "How \$100 a Month, Invested Properly, Can Make You Independent."



Mire: Rush to me without charge (1) sample alway Poetal Clerk and Mail Carrier Establish the question: 23 ell me bole to get a U.S. Covernment join (3) 4000 charge concluse involu

Travel-See Your Country Common Education Sufficient Men, Boys 17 up Should Mail Coupe

Address.

Name.

PATENTS

TRADE-MARKS DESIGNS FOREIGN PATENTS

MUNN & CO.

PATENT ATTORNEYS

Appeared since 1846 with the Scientific American

1583 SCIENTIFIC AMERICAN BLDG 44 W 44th St , New York City

322 SCIENTIFIC AMERICAN BLDG. Pathington, D. C.

1311 TOWER BUILDING Chicago, 11t.

664 HOBART BUILDING San Francisco, Cal.

519 VAN NUYS BUILDING Lat Angeles, Col.

Books and Information on Patents and Trade Marks By Request. Associates in All Foreign Countries.



To the Man With an Idea

I offer a most comprehensive experi-chard efficient service for his or dust, legal protection and the development of his proposition.

Send already, or model and description for advise at a cent proof bilineigh peter lighted but so per not are. Profundancy advice glad-ly furnished without change

My extendence and familiarity with various or a frequestic smaller me to accuracy ad-vise electrons to productive patentiality be-too they go to any diperson.

Stantilet of valuable toformation and form for superly disclosing your idea, from in re-nuest. Write today,

RICHARD B. OWEN

Patent Lawyer 6 Owen Building, Washington, D. C. 41-D, Park Row New York City

Advice for POPULAR SCIENCE MONTHLY readers regarding safe and profitable Investments.



RITE FOR FREE SAMPLES

Medican thirt Mafra, 142 Breedway, New York

PATENTS

Trade-marks, Copyrights, Patent Litigation, Handbook with illustrations, 100 mechanical movements. Sent free on request

ALBERT E. DIETERICH

Parmerly member Exemining Corp. U. & Patent Office Patent Lawyer and solution 27 years expenses a Washington, D. C.

481-A Ourse Bldg.

BOOKLET FREE REMOTRESS ASSURED

Patent.

PEALENS

Awtomazie

Stand drawing or model for examination and report on in justing tability
WATSON E. COLEMAN, Patent Lawrence

644 G Street N. W Washington, D. C. See Page 4. FREE 10 DAYS TRIAL-GREATEST VALUE EVER OFFERED

The Perfect Writing Writes with ink free and may as a lend peacil without a must, skip my blur. Its steady, uniform flow of ink actually improves a handwriting. Won't blot, scratch, leak de soil hands.

Makes 3 to 4 Carbon Copies

at one time with original copy in lak. Bear down as hard as you like without fear of bonding, sprending, insuring of distorting the

14 Kt. mild gold point,

point and tood, point and tood, point hand on priefy form on priefy form throughly pulsabed black material.

An Instrument of Saline

Equal is after warby and sopport for the sent of life the sent of To the order of the protection INKOGRAPH CO., INC. 185 41 Centre St., New York, N.Y.

SAME OF HEMISPHERE THROGRAPH

to elean or get out of erur-

AGENTS proces, we collecting, an example to the an inhappened or with the a

America's First Great Experimenter

(Continued from page \$47)

Of course, such phenomena as the effects of light and heat, particularly as drawn from the sun, were a neverfinling source of interest to Frankin In this connection, when he had become absorbed in studying what these two elements would do to various colors, he went to the trouble of cutting out a number of small squares from all the trated materials he could find. It being wintertime, he spread the bits out upon the mow, where the sun fell upon them, and then sat down to watch them closely. Lattle by little the black putch sunk into the snow until it disappeared. Next, the dark blue piece sank lower and lower, until it, too was gone, and so on, until at last only the white page remained upon the surface, almost unaffected Franklin had carefully taken the various tunes required, from the results he argued that these were due to the varying degree in which certain colors absorb heat, "It follows," he declared, "that is the hot summer months a man should wear white clother." asking, as his inevitable practical afterthought-" if he can discover may means to keep them clean!"

THE story of so long and so generally useful a life is crowded with meidents which serve to abustrate Franklin's versatility and his unabated curiouty. Almost any one of these is worth reteibing, either as a comment upon some historic event or as a measure of what was, and what was not, known in his day. At the outset, it was stated that looking at this amazing man from the single aspect of the scientific aide would be to make it impossible to peer around the angles at the other sides. This is unfortunate. because so many of Franklin's public and private expenences serve as anstances of his remarkable grasp upon all the mental, moral, and physical factors of life. Human nature, for example.

Once, when he was anxious to be reelected Clerk of the Pennsylvania, Assemlily because the job was both interesting and lucrative, he found himself actively opposed by a prominent member with a candidate of his own. Very promptly, Franklin sent that member a polite note, requesting the loan of a certain valuable hook in his library. The guileless owner having complied with the request, his book soon earne back to him with effusive thanks. What could the man do, when next they met, but show that he was flattered, by being affable with Franklin? Then it was too late to escape Franklin's trap, and the two became firm friends. As Franklin, in an aside, remarked "He who hath once done you a favor will be more ready to do you another, than he whom you have yourself obliged." A trick in practical politics, perhaps, but it is certainly based flatly upon psychology Franklin was never above applying anything that seience might teach him.

THROUGHOUT but life, Franklin had been fond of music, his interest in it lying rather in melodics and tunes. in harmony rather (Continued on page 149)

America's First Great Experimenter

(Cunhouset from page 148)

than in dissonance. In time, his fondness led him to applying to music his

seigntific mand.

He designed what he called an "Armomes," to be played by the fingers. This he describes as "glasses, blown as nearly as possible in the form of hemispheres," of varying sizes and each fitted with a hole or "socket" in the center With cork bushings, the spheres were mounted upon a spindle long enough to accommodate a "keyboard" of three octaves, the spindle being turned, very much like a sewing muchine by a treadle. The largest upheres were nine inches in dispicter, the smallest three inches, and all of them were ground very thin at the outside edges. They were tuned by grand ing them into agreement with the notes of a barparchord.

Franklin gave a few pointers on how to play his instrument: Wet the glasses with a spenge of clean water occasionally Turn the spindle away from you. By draw ing the fingers over the wet glasses, the includy is produced"-a glorified application of tuning a finger around the top

of a tambler

S A final Franklin touch, showing that A he was frugal, even in such pleasures as munic, he adds

"A further advantage is that, once well timed, it never needs returning

Very often, his experiments and inventions dealt, in one way or another, with glass. For another example, he is credited with having designed the earliest biforal spectacles. A pair of such lemmas was constructed, under his personal direction, in Paris. In describing it, he wrote that it had long been known that men often needed one lens for reading, and another for dutinguiding distant objects. His own experience was the usual one-having two pairs of spectacles, he always had the wrong one in hand. And at table he needed both pairs, one for seeing his fond, the other for reading the expression on the fare of his opposite French neighbor. Having hit upon the idea of the split lens, the two parts differently ground and then glued together, he was delightest. He was now able to manage both food and friends, metely by dropping his eyes or raising them. The device, he declared, as well as the rather stallic gesture of the eyes in "making it easier in understand and to be understood in Paris, has "helped my French wonder fully

CCORDING to history, has Prench A did not need much help, because, from the instant he set foot on French soil, he scored a sweeping personal surcess. For years, Poor Richard had been a sort of private Minister Resident and. when the news that Franklio actually had anded swept the country, every man and woman in it was thrilled at the idea of welcoming the great philosopher in person. They embraced the opportunity and, literally, Franklin himself. Far and pear, all classes, (Continued on page 150)



OUR OFFER:

Your first step-Before disclosing an invention the inventor should write for our blank form "RECORD OF INVENTION" This should be signed, witnessed and returned to un together with model or sketch and description of the invention for INSPECTION and INSTRUCTIONS

NO CHARGE FOR THE ABOVE INFORMATION

Our Four Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Convains full instructions regarding U. S. Patenta. Our Methods, Terms, and 100 Mechanical Movements illustrated and described

OUR TRADE-MARK BOOK

Shows value and necessary of Trade-Mark Protection. Information regarding Trade-Marks and unfair. competition in trade.

OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

Progress of Invention

Description of World's Most Pressing Problems by Leading Scientists and Inventors

ALL COMMUNICATIONS AND DATA STRICTLY CONFIDENTIAL INTERFERENCE AND INFRINGEMENT SUITS PROSECUTED

TO MAKE YOUR CASE SPECIAL AND AVOID DELAY YOU SHOULD HAVE YOUR CASE MADE SPECIAL IN OUR OFFICE to secure protection. eave correspondence and obtain early filing date in Petent Office. To secure special preparation of your case cend \$25.00 on account with model or sketch and description of your invention.



Private Office, Victor J. Evans, with View of Patent Office Through Window

FREE Coupon

Premopt Attention Highest References

VICTOR J. EVANS & CO., Patent Attornoya Main Offices: 769-9th St., N. W., Washington, D. C.

New York Offices (beings Offices, 2534 Tacsima Bldg.

Philadelphia Offices

Pittsburgh Offices 514 to Liberty Bidg 514 Empire Bidg.

Gentlemen: Please sand me FREE OF CHARGE your books as described above.

Address

EVIDENCE

DIN ENTROS

BRASK

12A 14

HOW TO GET

IN RESIDIT

DANDER PH & CO.

NVENTORS PROTECT YOUR IDEAS

Before disclosing your invention send for our Evidence

of Invention Blank. This should be signed and witnessed and returned to us with a model or sketch and a description of your invention for our Inspection and Instructions which are free.

Also send for

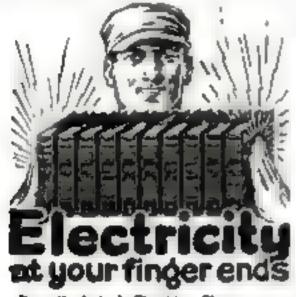
Our guide book "How to Get Your Patent" which is sent free upon request. This book includes full instructions regarding U.S. Patents, Trade Marks, our Terms, Methods, etc.

WRITE TODAY

Terms Reasonable Best References

RANDOLPH & CO. Dept. 130. Washington, D. C.

1	ANDOLPH & COMPANY, Weshington, D. C. Dept. 136.	
	Pirese and me PREE OF CHARGE your bridence of Invention blank and your guids "How a Get Your Patent"	
i	lame.	
i	trust	
	ity State S	



Energy the facts in Electricity. They been more provery and better position for you. Hearting Guides but you all you have to know about Electricity. Every important object and positive for proving interested by Eury to study and operiod in your ten understand in. Eury to study and operiod. A complete, practical working source in 10 volumes. Orders set to day to leak over.

HAWKINS GUIDES

STOO PAGES

121734

These books tall you all about — Esperiments — Industry — Esperiments — Dynamas — Biccrie Machinery — Motors — Armetica — Armetica — Biccrie Machinery — Motors — Armetica — Armetica — Mindrogs — Installing of Urinamon — Electrical Instance of Trustry — Practical Management of Dynamon and Motors — Distribution Systems — Wising Despense and Missing Despense — Missing Despense — Missing Despense — Missing — Practical — Allegants — Circuit — Missing — Missing

SHIPPED TO YOU FREE

Note cent to pur carll you may the busin. He obligation to half thing you are mainless Send output new today and get thing gives help observe and set it is to the the 100 to your pay you group the first worth 100 to you pay if (0 a major h few two quantities or nettern it.

THEO, AUDEL # CO. M W Zhil M, R Y. Phase mbut the emparation Hawkins Electrical Golden Price \$1 meh: Ship in page, prepaid, the 19 Dutmoers If mustactory I will agree to

Name Address Chemmonaut in e.

Employed by





United Bratin Cattrol.

PATENTS

DON'T LOSE YOUR RIGHTS TO PATENT PROTECTION

EVIDENCE OF CON FYPTICING LIVE IS did do not be a second and the se h i a d'intra pu ne l' d'a an l'i da sel a n'e l'illian de sel an e n'e l'illian de sel an a destarbante de se colorie se

LANCASTER & ALLWINE

276 Oursy Building WASHINGTON, D. C.

Augustus of Icras, "Endoor of Consuption,"

America's First Great Experimenter

(Continued from page 149)

high and low, united to do him honor. The cusch of one noble or another was always waiting before his house in the saburh of Passy, to drive him into Paris in state. Along the road, to gape at the famous man, young peasants crowded about the gates of humble cottages, whose ald ones craned their shriveted necks out. of the windows for a glumpse of him. By sight and by name, everyone knew him His old fur hat whether he wore it whally to keep his elderly head warm or partly because it was popular, pever appeared in public without starting the applause. It was taken as the mark of gentus, sientifying Franklin, among the French, as the peer of their own Rossseam.

WHAT he said was repeated from mouth to mouth, what he wrote was translated for general distribution, and he soon became as much a figure in Paris as the King himself. Indeed, more so, since he was regarded as the embodiment of democracy, just then so near its bloody birth in France. Epigramii upon him were abundant, such as Turgot's "He has torn lightning from the skips and accorresfrom the hands of kings " When he was introduced to Voltaire in pribac, it was not enough that the two should shake hands; they were forced to long each other in proper Prench fashion.

As he entered the ball of the French Arademy, founded a bundred and fifty veam before by Cardinal Richelsen and ever since a proud body, the members, toa man, rose to their feet. Horown election. to membership was the merest matter of form, by acclamation

Inventors clampred to show him their newest machines, scientists eagerly apoglit. his opinion upon the results of their tatest experiments, and pholosophers tested upon him their most radical theories of life.

The lving received him royally and presently made him a member of a special commission, appointed to make a thorough examination into the methods and claims of a certain Dr. Mesmer, just then widely noted for miraculous cures which he was supposed to have effected.

THIS doctor was the first to proclaim the theory of treating disease upon the bases of animal magnetism—the art, science, or trickery, according as opinion varies, which has ever more been known as Mesmer-ism. Solemnly collecting his patients about a bucket, and thrusting iron rade into their hands, he made passes before them, stuck a sudden finger into their faces, or touched the spot where the gout, rheumatom, or what we now call arthritis was supposed to be lurking. According to rumor, the halt, tame, and blind immediately forgot their adments and went home rejoicing.

Soberly the commission assembled to investigate all this. It can easily be imagined how such an affair would appeal to Franklin. His mind, clinching upon the investigation, would not let go until every drop (Continued on page 151)

America's First Great Experimenter

(Cantinued from page 150)

of information had been squeezed out or until a reasonable conclusion, as far as it might be humanly possible, had been definitely reached.

The commission watched the doctor "operate," The learned members marked the spasms, the reactions, and the very beartheats of all the putients. If the girl A... admitted a sensation of cold, when her laine foot was touched, down into the record went this admission. If the boy B... confessed to a sudden flash of inward heat in his twisted left arm, thus too, was calmly noted and gravely discussed. But, since most of the patients treated before the commission could report no sensation at all, the results were meager.

IT SEEMS probable that it was Pranklin who suggested the next step—that the seientests should themselves be treated. One and all, they followed the course of buckets, rods, and waving fingers, each going through the treatment alone, in order that his sensations or his opinion night not be influenced by a colleague. Unfortunately for the learned Mesmer, the only result seems to have been that one commonomer felt a "severe paid in the pit of his stomach." All other efforts drew blank.

Another set of patients was assembled at Franklin's house in Passy, for a further series of entirely unconvincing tests. Then the commission submitted a long-drawn, meticulous report, stating that Dr Menmer had really shown them just exactly nothing and concluding that "every process, in which the means of the animal magnetism shall be employed, cannot fail, in the end, of producing the most permeious effects."

Another chapter of this fuscinating story of Franklin will appear in next month's issue. You won't want to miss it.

Beheaded Butterflies Live On

THAT butterflies not only continue to live with their beads cut off, but actually survive those not subjected to decapitation, was the announcement which recently caused a stir of excitement among members of the French Academy of Science. This experiment, termed one of the strangest examples of amentific research work in biology ever recorded, was carried on by Abbé Cambout, a Mariagascar missionary and biologist.

A new method of bloodless decapitation which the missionary biologist has developed contributed largely to the success of the experiment. Eighty-four butterflies were put under the kinfe, and a like number were allowed to retain their heads. Without exception, it was reported, the headless ones outlived all the others, Scientists, to account for this strange experiment, are advancing the theory that loss of the head reduces the amount of physical exertion necessary to sustain life.



The brooklet strong here contains calculate information teleting to parent procedure that go very monitor should have. And with it is a period touring my likewish to the cancel of its entropy of which you can elected your adminish shots of the date before a national High evidence may been prove valuable to you, brough man the componental is send you the booklet are the its order of levent in form.

and the Resort of Investion form.
logether with detailed aformation on him
to personal and the costs involved. Do him
No W. No quelt lose a nation to time. The
coupon on brong you complete safernation
materly without charge of obligation.

Clarence A. O'Brien Registered Futant Attorney

Member of flor of: Supreme Court of the United States Court of Appeals, District of Columbia, Supreme Court, District of Columbia; United States Court of Claims

Practice confined exclusively to Patanta, Trademarks, and Gopyrights

Mail this Coupon How!

Citemate A. O'Brica Registered Fatest Assermey

16-G Society Beringt & Com. Bank Hidg., Washington D C.

Piece and me your few book, "Boy in Chicas, a Parent and your libered of invention" form without my root or obligation on my part.

Zeme

Address

(Impactant: Frint or Write name clearly)



Amazing Advertising Offer to Introduce Improved Burner

Now, if you act promptly you can own a new, impreced Oil Burner at annual maly low cost. For 10,000 new, im-

proved Oliver range and stove Burners are to be distributed at helf-price—as part of a greatic advertising campaign

Tipe ment mensational barges most barges most barner intory is more offered something was proposed to me the many adventages of this improved device over old, productions



Absolutely cale. Odneless, wirkless. Installed in 15 minutes. Lasts a lifetime. Complete heating settimention is guaranteed.

Remainder, over 278,000 Oliver Burtiere have already been mid. These already been mid. These already because the first as this sensettional price. Get his of the dirt and sensettional price. Get his of the dirt and sensettional price. They right quark, educates on beat. Been no money. Just mad be rougher and reporter yourself for this lifet me appearingly local maint your chance. ACT. YOU.

Obser Oil Burner Corporation, P-341 Oliver Building, St. Louis, Mo.

HALF-PRICE ADVERTISING CERTIFICATE

\otimes	AGERECIAL COU	POW OFFER	Ľ
0000	Orthog Dil Sagrage C. P-341 Ottogr Schiller Plates register day out advertising after and ou I am interpreted in a bo Escaping Start.	rg, \$L. Louis, Mg, too for your half-gates ; and details great for may	V-V-V-V
Ğ	Name Address. Toro	Columnia Blade	

Why Men Beat Women at Sports

(Continued from page 21)

mighty wallops of long-hitting men stars. That is one of the reasons why good men golfers beat good women golfers—their superior driving ability, the result of greater strength and usually of better timing, makes it possible for them to get closer to the green with their first shots.

But it is not only in driving that mengolfers are superior. They have more limity—more finaling punch—than women. Their short game is better Women golfers—with a few outstanding exceptions, of whom Moss Collett is une—do not hit their approach shots with the same confidence as do the male stars. And, strangely, in putting, a golfing art that requires no strength at all but much delicacy of touch, gentle woman is completely outclassed by blundering, heavyfisted man!

QUITE possibly women labor under a temperamental handscap on the links. Golf is a game that demands many decisions, and decisions which when once made must be acted on with confidence. Women never have been remarkable for the ability to make up their minds quickly, and to keep them made up. This lack of decision may account to some extent for the undisputed fact that men can beat women playing golf

Outshining all the other colorfal personal ties who have adorned our sport pages and illustrated supplements during the last eight years is Mile Susaime Lenglen greatest of woman tenns players.

Sitzaine has been no blushing vadet of the fields of sport. Possessed of the stormy temperament of the conventional prima donna, coupled with the publicity sense of a high-priced prem agent, she has kept herself before the eyes of the world. Spied of foot unusual in a woman, amind strokes, and a fine tennis brain kept her the almost undisputed queen of the amintenr courts until, a few weeks ago, she startled the tennis world with the associatement that she had become a professional, and was going to tour America under the management of Mr Charles Pyle.

M LLE, LENGLEN is the world's best woman tenns player, but she is a long, long way from being the best tenns player in the world. Big Bill Tibles is reported to have besten her in love sets, without taking his sweater off Little Bill Johnston and a dozen other male stars undoubtedly could dispose of her quite as handily. She has been besten, in more or less friendly matches, by several third-class men players. There probably are at least two hundred men in various parts of the world who could best her.

Women's tennis has been much over rated. Action pictures of woman stars in play give the impression that their game is as fast as the men's game. It isn't anything like as fast. Mile. Lengton has a restain degree of speed of foot, but little speed of stroke. (Continued in page 153)



EARN UP TO \$250 Per Month — Expenses Paid

Louised opportunities to the new profession Travel, need big relievely officials. Preparation easy of manufacture to me at any

START AT \$120 PER MONTH. Expenses Paid t per graduation we seeme position for you or refund your money. More non personal



Learn How to BOX

JIMMY DEFOREST
BOXING COURSE
Teacheaby me linearma
eyeter he raught Chapte
pion JACK DEMPREY
le 30 maste under the Portel of
Jacob Sevent Toriff demini
Trainer and Maker of Chapterers

pion JACK DEMPLY

10 30 masta under more Post of all
Joseph Special World of Armed Special
Process and Makes of Charle provide
Joseph will master be principled by the model and forestime the sp
Joseph pi achieve James De Forest
Joseph pi achieve James De Forest
Joseph pi achieve James De Forest
Jackson James De Forest
Jackson James Jackson De Forest
Jackson Jackson Jackson De Forest
Jackson Jackso

The gen entarrant from all classes and compared to be belief propared to the bearing engagements. The action purple are beliefly propared to the bearing engagements. The action purple are beliefly by the Penalt on some English the best trees and another through the left personal on some probability in the former made above the best to the best bearing the primary of the best personal to be fit by the property to best and which is a compared to be the property of the property of the best are the property of the best to be the property of the propert

JIMMY DEFOREST BOXING COURSE, 347 Median Ave., Box EZI I, New York Only



Photography Phone

Many many \$2.400 to \$2.500 a year. From my split bdy rise ing appear from Anny depend which play many. Note thing described discussing case that it hand it was a for from boats. Departmenters or Manters Phintings should be a for from boats. Departmenters or Manters Phintings should be a many.

Popt, 1948, 1953 Withings Ave., Chinago. U.S.A.



DRAW CARTONS

Cartoophite each from \$50 to \$500 per terms some effect to the Remarkable ben (Trebe System of Drawing Caption you a half the sense time Send for bunkles and sample benon place of the Papers foll detacts of the Course The National School of Cantooning foll detacts of the Course The National School of Cantooning foll detacts of the Course The National School of Cantooning following fo



Read Interesting article on Page 4. "How \$100 a Month, Invested Properly, Can Make You Independent."

Why Men Beat Women at Sports

(Continued from year 185)

She was her matches against other women by being able to reach their best shots and send them back safely; most of her points are won on her opponents' errors. A man of Tilden's caliber would put so much speed on the ball that she could do nothing with it even when she reached it, which would be seldom.

Muss Helen Wills, our ex-champion, gets good pace on her ground strokes when her opponent allows her to get confortably set for them, but she is painfully slow of foot. Any of the really good men players could up her game to pieces by forcing her to run after the ball

One explanation of men's ability to beat women in tenns in that usually men are taker and heavier than women. But that explanation becomes no explanationatall when we think of Billy Johnstin. No taller, and rensiderably lighter than Men Wills, her fellow Caulornan can but a forehand drive as hard as any man and a lot harder than any woman, in tennos.

EN tennu players best women ten-M nu players because the men have greater speed of foot, more endurance, greater bitting power, and en ne times out of ten-greater factical ability. Can you imagine any woman ever being able. to play the sort of tent is that "Red McLoughlin played to defeat the great Norman Brookes by the score of 17-15. 0-3, 6-3 in the Davis Cup matches of 1014? During every one of those fifty ! hard-fought games "Red Mac ' went storming in to the net belund every service and behind almost every ground stroke. No woman who ever lived could lave stood that strain.

Women's interest in track and field athletics is, to a great extent, a post-war development. For some years a few girls' achools and colleges had encouraged this branch of sport, but it was not until 1948 that the Amateur Athletic Umon took over the government of the sport, and open competition became common.

WHILE they have made great progress in the spiked-shoe game their best efforts still are a long way behind the efforts of second-rate male athletes. The women a workl record for 100 vards in 11 seconds, made by Miss Fanny Rosenfeldt of Toronto last year. Almost any boy high school runner can equal that mark The women's record for \$70 yards is \$74.5 seconds, 7 seconds slower than the men's.

The women's record for the running broad jump is 18 feet, the men's record is 25 feet 10% inches. The women's record for putting the 8-pound shot in 38 feet 3% inches; twenty years ago the gigantic Raiph Rose tossed that weight 67 feet 7 inches. The men's official discus weighs 4 pounds 6% ounces. Jim Duncan threw it 156 feet 1% inches to make the present record. The women's official discus weighs 2 pounds 12% ounces. At this year's championships Miss Lillian Copeland set a new record with a throw of 101 feet 1 inch. I notessed on page 14.





DRAWING & FORTUNE

Ab Hafed, a Persian farmer, sold his never to go out and seek his fortune. He wise bought the 'a militaria's constant a discussion began with his hade him farming by yet. She thought as choused the great apportunity at his door to go far afield in meaning it wealth, which dispersion a great truth.

Do You Like to Draw?

If you do, it is no almost be two adjection that you have as a short which has proceed. Then that is a thirt which has proceed that her for the above topy your talent, you relations need by your ballot.

MANY EARN \$200.00 TO \$500.00 A MONTH AND MORE

Present support interprets note note man and women in a set that inaperior resides a a c'e have to set seen a cle have to set seen a cle have to set seen a cle have to set set a cle particle of set are a cle particle of set are a cle particle of the highest type of art - pleasant a conjugation.

THE FEDERAL COURSE IS A PROVEN RESULT GETTER

It in the body Roose Study Course which has been built by over they had early known as own Societies because the H. Course I large Charles as appeting that and hoptome hou among them.

Free-"A Road to Bigger Things"

I you like to draw you should rund this free beach between the could rund this free beach between the runds of the party party for worth it tolks above. These was up as a time p party, function this production and a such by tarries a mate who have being buying the runds at the runds of the runds at the runds are a such as a

Federal School of Illustrating

11146 Federal School Bidg., Minneapolis, Minn.



Why Men Beat Women at Sports

(Continued from page 155)

George Vreeland, chairman of the athletic committee of the Prodestal Insurance Company Athletic Association of Newark, New Jersey, has, as a volunteer coach, trained many successful girl athletes, among them bliss Hazel Kirk, joint holder of the record for the 60-yard hurdles. I asked him if women track athletes ever would become as good as men athletes.

I DON'T think that there is a chance of it," he said "(orl runners have improved greatly in the last few years, and they will continue to improve, but I doubt if they ever will develop the strength to compete with men on equal terms. You know how untrained girls run on the street -almost waddle. It is automishing how quickly they get over that when they put on apiked shoes—how they learn to strate right out like a man.

"Competitive temperament? Yes, they have every bit as much as men. And they re every bit as good sports. Diev like to will, of course, but the track game mon teaches them how to lose gracefully. There is an exception now and then—but I've seen one or two men athletes who weren't good losers!

Women have to be trained rather more excels than men they can't stand as much work and must be brought asing more clowly

I ASKED Mr. Vereland if any outstanding girl athlete had been developed in the United States.

'Probably the best all around girl athlete we have developed in America is Miss Helen Filkey of Chimago. In the 1965 national women's championships in Paradems she was three events—the 100 yards, the running broad jump, and the 60-yard hurdles. Possibly she could have done even better than that, but no girl athlete is permitted to compete in more than three events in one day

"Just how much women will be able to improve their track recueds as a matter for guessing. In the 100 yards, for example, a second has been elipped off since 1972. But the next second will be harder. I doubt if any woman ever will con the hundred in ten seconds flat. In fact I doubt if a woman ever gets under 10.2.5 seconds."

Men, it seems, are able to beat women in sports just because they are men, endowed by nature with superior qualties of speed, strength and stamma.

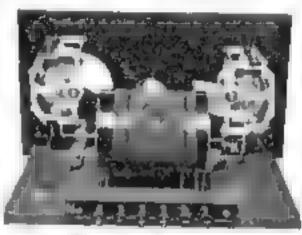
New Test for Headlight Focus

WHEN the bulb in your automobile beadlight is focussed properly, the rays of light travel in parallel lines. Advantage of this fact has been taken in a new system of headlight testing.

Two steel plates with a circle of small holes bored in them are held as front of the headight. If the beams of light which pass through the holes register upon the holes of the outer plate as viewed upon its inner surface, the headights are in focus.

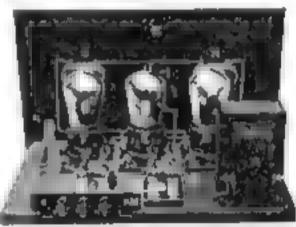
Make Your Own Radio Set

Popular Science Moximix publishes rehable blueprints of radio sets. These sets give excellent results and can be made by anyone who is handy with tools.



One Tube Radio Set Biueprint No. 41 - Price, 25 cents

Describes a simple, one-tube regenerative receiver of the fixed can type. The regeneration is controlled by a yapithe conduiser and does not affect the wavelength adjustment. Quantity of reproduction is excellent because no audio frequency current flows through the tickler coil. The coil is hand whend and the rest of the parts can be of any standard make.



Three-Stage Amplifier Blueprint No. 43 Frice, 25 cents

Describes a three stage audio amplifier to be added to one tube set of No. 41 to obtain loadspeaker results. In equally useful with any other standard one-tube detector circuit. Consists of one stage of transformer coupling, followed by two stages of resistance coupling. Volume control is simple and does not affect quality of reproduction. This bluepant does not describe a radio receiver—it is simply an audio amplifier to be used in connection with a one-tube radio receiver—



Four Tube Radio Receiver Slueprint No. 43 Price, 25 cents

Describes a four-tube radio receiver consisting of one stage of radio frequency amplification, a regenerative detector, and two stages of transformer coupled audio amplification. It gives the greatest power for distance and volume that is obtainable from four tubes. Easy to build, uses any standard parts except the coils, which are simple to wind by hand. Two control tuning and regeneration does not affect wavelength adjustment.

POPULAR SCIENCE MONTHLY
256 Fourth Avenue New York City

Thrills I Never Had

(Continued from page 15)

ing, if not drowning, was bound to be our lut.

"Slowly and pandully we begin to climb upward. But the sea caught its and dragged us back. We shoped on the ice-sheeted rocks. We were brused and bleeding from our falls.

"When daylight came we managed to find a shelf of rock high up. We huddled down close together for warmth. Right before our eyes the ship was torn to pieces. by the huge mountainlike seus that came maring over ber every manufe.

"Some farmers out looking for their stock, which was dying in the storio. came and rescord us. It senusts simple, but I wake up at night mometimes in a cold awent and wonder if I am still alive."

I THINK Colonel David Bramard, U.S.A., has even better cause for pight aweals. He is one of the last two or three survivors of the Greeley expedition's heart-renders tragery of forty years ago. In the Army-Navy Clob in Washington, with white-haired General Greeley himself at the other end of the big mensorial room, he told me fragments of that normble atory

There were twenty-five in our party, which based at Lady Franklin Bay in Elberners Land near the shores of the Arctic Ocean. The rebel stop faded to come. We retreated by long loat to Cape.

When autumn came we built a little but of rocks with walls only four feet high. In the center was a flat stone on which we kept a tmy fire burning. For a roof we had two boats apside down and some oldcanvas. In this rude habitation we lived for the better part of a year.

"We had almost no food. When the sun left in October we were already starying. This meant weakness, which, in turn, meant low resistance to cold. One man had both hands frozen. They fell off. To one of the poor fellow's stumps we hashed a spoon so he could cut.

' By good link I was among the few strongest, I harded daily. But the darknem, the violent bitter winds, and the everdrifting anow gave me no chance for

"Our party began to die one at a time. There was no soll under which to have the bodies. We supply laid them on the rocks and scraped gravel over them to keep the foxes away. One man, Henry, we caught stealing food. We shot him. That was a glustly day.

"DY FIRST of the following June only D one or two others besides myself could walk. As it was believed a ship gould not reach us this early, death seemed certain. The procesome effect of the fifteen or so dead bodies lying on the rocks in plant sight cannot be described. We gave ourselves up for lost,

"Then a miracle happened. A few days later I thought I heard a ship's steam whistle. I concluded that my sufferings had caused me to lose my mind. Then I heard it again. This time I crawled out of our but where (Continued on page 156)

Laugh If You Like-/



-But I Did Learn Music Without a Teacher

one had been ended on to enjertain such all had responded with a sea g or with a selection on some musical distration). And now it was my turn

I had always been known as a "set in the ermer. I had never been a de to e toer sing or play. So they all marmured as I similed confidently and took my place at the punne. Theo I players "punyed astronom else. had played that evening. First ballada, then classical numbers and popular tunes

For the first time in my life I was the very cepter of althuring.

They had listened—dumfounded. For a moment, now that I had finished, they remained silent. Then thunderous applause! Then questions.

"How did you do it?" they charged "And you're the one who goth t know a Why didn't you tell is you were taking lessages privately? "Who was your

For a moment the questions overwhelmed

"Tencher" I never had one " I repled, I learned by myself, at hum-

They laughed to disorbed

"Laugh if you want." I countered. "I did learn motests was beingt a beautiful

that if we note I define know one note the absorber I have being a Part I element of the account had to have smost be perome a more man

It is all his or how I we just not no und while the year of a new tell allows. Time actes that I beinged to be able to play

Then he might I not ut hoose alone resulting a management. It told if a new cases not their

the water to according to represent the light it rights to water. After all the release to domain the right is got to the company page with 300 know the sust

Pare Hop Parelle

Tradit Step of a Seed Guide

Sure and spents baltat Augustatic Piters Corns

Promotion ideas Rects to Pleaters a

T prober s

Sautphint Cornel

The course Lea detocal to them, was more helpful times for a limit of an audit it was accordingly at one even a chall could be a to play this quick, a as was lettered a once Andle a to be very been a one to me the court in the court of a court to be a court of the court of t for his a regular temperate It was just like a uncl-

New Least play anything gain or elastical T a low set with the control of surey bear a state of the control of

You the can leave to pure our favor to find asroom to stangers or home, method but hag helpera he med he as institute secrete to the other discovering and interest of green. A sured on the extension was bring about the extension over the early secret and the extension over the extension of the manual plant of the extension of the manual plant of the extension of the exte

Free Book and Demonstration Lesson

than to make that Book is ear from which and may from the artist to the transfer partie that they are taken in the fitter of t

Ham town y want victoria to may of new friends, g of these eachs separate y and meresteed them a squared of the same Signature competer and an all it is nearly a supplied which is because in a same to be supplied which is because the light of the same that the second of Munic, and Beumawick Bidg N Y C.

C. S. SEFFOOL OF MILSEC.

bid Brunowich Bidg. New York City.

Photos send me your from book. Music Lements in your send forme with in colorates by the frank for twenter after leasen and on builder of your type and today I not abbrevator to the following courses:

Address

Atman





Easy to Draw Cartoons When Shows in the RIGHT WAY

finne of the directory territorists and comic artists learned how to draw in their promp time by following Cartenaist Learn Simple and Ever to Learn Mathed and are now MAKING (COM) MONEY Send one of your drawings, and let Mr Benname it you have ability and readire the Portfolio of European and full details about the course. It is not expensive.

THE W. L. EVANS SCHOOL OF CARTOONING



the second part Although his limits a perfected execute he work her could be remark abuild and its are furnishes a com-plicit with of impreciate much 1141-00 without even could 3 distributed by the former almost ad unce-

MANY MEN

july the Propose descripforestate height of more flower than the set of the second of the transform of the second of the sec herman July and same

Benutiful Book FREE

The benight Roch of Firestic Habraches Tigg-ing set in order explains as in ferral tip order explains as in serin tenney as laster I will be sen our glander in will be sen our glander in till in the sen our glander in the inter-inal the designer of the co-tenies by a course of the co-par per size for its the pole at phose with appointing he performed mombers are a sublimbe

A STATE OF THE PARTY OF THE PAR Dept. 51-8, Advisor, Mich.

******************************* Physide Industries, Dept 32 3 Adrien, Mich. Figure send the FREE the book on Fireside John cites. which explains how I may man maney a home in deeper-ing are no cities about per impore of our maney hack guarantee and special overwhite pilet spec

Address

CHIP

(Write to procit—tok will block

Thrills I Never Had

(Continued from mag. 160)

Greeley and the others were dying, and staggered down to the shore. My heart leaped. Not one, but several rescue ships had reached us under the countgeous leadership of the late Rear Admiral Schley. We few survivors got safely back to New York, but the lives of nuncteen of our brave comrades had been sacrificed to the ruthless North."

I have known and listened to men like Byrd, Stefansson, Carl Akeley, Amundsen, John Rodgers, Shackleton, Pershing. Sims, Stewart Edward White, and a hundred others of their wonderful tribe. But in the last analysis it seems to me that the two classes of men who have the highest batting average in hairbreadth escapes and adventures are, without question, straightaway mariners and detectives.

SHALL give two beief incidents to allus-A trate my point. There was old Cap tain Peder Bane. For fifty years, boy and man, he had sailed every sea on the globe. He had enough harrowing tales up his sleeve to stock a library

Once he was in the Caribbean in a sudden blow of hurneane force. With the fore-topsail even he last out to the yardarm to pass the reel carring. Next thing. he knew the ship gave a wild linch and he lost los hold. As a run squall was m progress. Pedera fall overhoard was not seen by the man at the wheel. The slup-

Providence saved his life by having a drifting spar floating on the sea a wild surface near where he fell. But Providence added seat to the situation by keeping the hurricane going for five hours and bring-I mg a sheal of sharks alongside poor Peder's slender raft when the sea fell.

Followed a game of tag, so ghastly that: Peder's hair turned white in the two days. before he was picked up. The sharks increased as mumbers as time went on They seemed in no hurry to eat their prey But they took turns in going up for a inhble. Peder had to watch and dodge at each attack. Anyone who has ever seen a shark strike will appreciate the horror of his plight,

CTRANGE to my, another castaway I saved him. A drifting bout without ones or sails came close to Peder's spar-He took has life in his hands and swam to t with the bust vestige of his strength. He found in the boat a man half-dead with thirst, but luckily equipped with rifle and plenty of ammunition. Peder did the human thing. He broke open the amour intion and set about kitting all the sharks he could list. In the midst of his manuscul executionings, a thip came along and picked the pair up

My detective I shall have to call "Mahin," became he is right now at work in New York on one of the biggest cases of his career. He frankly admits his greatest thrill is in "getting his man first.

" They shoot to kill these days. Mahin told me. "The week before last Christmas I was called in on a case of perustent shoplifting in a big jewelry store. In forty-eight hours (Continued on page 157)



1000 NEEDED

Here is the quast requiremble book over offered to reserved the financial more of the financial of the Control of the remaining else the films ever been particles. Compaled at emission is expense. The section is tay a middle particle that is tay a middle of the section of t

BURTAU OF INVENTIVE SCIENCE Dept. 315 Rechester, New York.

THIS WONDERFUL INVENTION



come and may undersay coulstory difficult gas faithe ker orne enr uit. Un oper cleaner and those effected than of Texas for all hearing purposes. Rimmen pilds of all this after watered

GLOBIA LIGHT COMPARY. 127 N May Str. Chicago, III



Great Athletic Book 1

Postrong and athieter. Lauren probabilities and athieter. Lauren probabilities and athieter. Lauren probabilities Let Phieterson Barrers. high Preside the Phieter Probabilities and the Phieter Probabilities and the Probabilities and Proba

HAVE YOU AN INVENTION?

It so the WORLD PROGRESS will

ared was upon request enough only fire containing to graduate forecasts as to inventions breeded. We do not more accurred to address to reputing level those they want. Subscription for one year oil containing the con WORLD PROGRESS FUB. CO., INC., run 102 Victor Stdg. Washington, D. C.

COPY THIS SKETCH

shift but the one what is the de with a fine factors of the arms of the state of the arms ency observed being an pare sug-casy observed bytes a pare sug-tern of the both as pare to form one on any accepts chart to next yours ability

THE LANDON SCHOOL \$51 Kational Bidg CLETELAND O



Advice for Popular Science readers regarding safe and profitable investments. See page 4.

Thrills I Never Had

(Continued from page 150)

I cornered the head of the gang that was operating. But I had to wait in his rooms for his confederates.

"They arrived in about an bour. There were three of them. Apparently they were warned. All three covered me instantly, despute the fact that I had a drawn gun ready For about half a second nothing happened. I guess we were all the king two lightness.

"Then I let drive with my automatic at the middle of the three, throwing myself andewise to the floor at the same moment. Three bullets crashed in the wall right behand where I had been standing. But my first man dropped in his

"AS I but the floor I fired again and rolled as hard as I could toward a chair. I gambied on the meet of furniture distarbing the som of the robbers. account rounds just as my jump had made them mose their first. But this time I felt. a slarp blow and a violent burning sensahan n my left leg, a flesh wound. I had two more rounds left. I fired both from inder and half behand the chair. I was tal twice more, but not seriously. The third man dropped mortally wounded by my last eartridge.

Ten minutes later the police ambulance took one enpire, two dead bandits

and me to the hospital,"

I have never had a thrill like that. And I never want to have. Do you?

Students "Hear" Plants Grow

BY TRANSLATING the growth of a students at the University of Pennsylvania have been able to measure just how much the roots develop from second to second.

The instrument used is a sensitive "ustra-micrometer" and principles goveraing the operation of may ordinary racio set have been acapted to the task

Every fan knows that a change in the relation of the condenser plates will produce a corresponding piteration in the

freq inney of the current.

This fact was adapted by the students to the measurement of plant growth in a special "ratio set" so arranged that the root of a plant was made to press down on the crossbar supporting one of the condenser plates. The resulting changes were beard through onlinery headphones. like a series of oscillations which could he counted with the aid of a stop watch.

Electrons Not the Smallest?

GAIN science may have to revise Ants theories of what constitutes the smallest thing in the world. Sir Joseph Thomson, noted British physicist, has suggested the existence of particles even smaller than electrons. These particles, he says, may form an atmosphere surrounding the central nucleus, the protons and the electrons which make up the atom, and it may be that their impact causes the protons and electrons to vibrate and send out energy.

A FRANTIC CALL FOR MEN WHO CAN READ BLUE PRINTS

OF BUILDINGS ... at \$4,000 to \$12.000 a YEAR

See how easy it is to get in the building game. Nowhere circ duet such simple training count for so can h. Nowhere circ can a many make \$6 000 to \$12,000 a year on quickly and so easily. Numbers the age there so many counties (hopeands of openings as there are with contractura, builders, and real estate firms, who are constantly calling for men who can read him prioris. Set billion deliare a year in apent for building. Trained even are at a premium in this greatif industry. Intold thousands are need d at stendy anisries far abore the ecule wage.

DAYS EASY TRAINING PUTS YOU IN THE 6 - BILLION - DOLLAR BUILDING FIELD

NO longer as it becomes to start at the bottom of the builting trades and spend years to work up. Now you can get three years' tearing in three mont is. Thereare no barrows to your successing the great out loor turbung field. You do not need more than a common school of matron. We train you at home, in apare time. by the fase nating blue prant method with French that are as easy to true as your true paper. These central came raise a your found the direct and largest to both of confidence construction to the countries. by This is an exceptioned by leading contract on. These gains and glube and is some a to the hard of Toronto the party of the second of the party of the man and the party of the second of two actum bige print

IF YOU LIVE

IN OR NEAR

CHICAGO

Viett our School for Builders open day of

mustages open day of even ag. Thousand men strend early year flater had congretation before the grant for the gland parties agree for another plants parties for the That I respect to the That I respect to the the grant for the the grant flater of the gra

place from process of bandsing experts range less to been to read all the plane retunate the rests and supersus the color room action of a beatifure every thing a con the or has Advent which he upthe traces by me medium

A naring governmented त वन्त राष्ट्र करणात्र) ना है राज रेग्न करणा व वस्तुता करी तसह सुरू करणी e i i ge sob I herr be true hours or date inforce the cent outle of profession of the b that page bunderone

tennys Chiff on Sety III went fire cle har head. beings. Cliffied Schill went fire cle k. 1. And t. Super introduct at diff, includes in balais to b super in Thomsands of contractors need need his Clifford behalf.

CHICAGO TECHNICAL SCHOOL FOR BUILDERS

Dept. M-40, Chicago Toch Bldg. 118 E. 26th Street

Every Job Must Have a Contractor

The building field is wide open for men who want to go to prepare the street of the street was the property of the street of

Petrote as to be the spheres of a life our hope to the a business of conceases as a rest of the building house on the sphere as the building house on the sphere of the building house on the sphere of the sphere o

erandrig ja tiin teemeagagi field mini it (aagantide exert tay Ta k a empen or office man ar oriek iyee the property of the second of

FREE Trial Lesson

Principly than It there may promite by the man happens of the hardward long. From according to the major tail are forten and the Phant sping. The major tail are forten and the Phant sping. the number of the state from the pill among the Number of the state begin an expensive religion to the first term. The term of the religion of the

contact to here therefore made the magnetic before presented the first present to the property and the magnetic before the foreign the property of the first transfer the property of the prop Name top, at hous addict law, your free least to have to be the first and any full translate of or course and he support any less in his - idited that I be understood that oo substituting the course. pi tima in Арт (Эторилия Антентрация принцерний принцерний принцерний принцерний принцерний принцерний принцерний принцерний принцерний

Read interesting article on Page 4, "How \$100 a Month, Invested Properly, Can Make You Independent."

WORK FOR "UNCLE SAM" RAILWAY POSTAL CLERKS MAIL CARRIERS

\$1700 to \$3000 Year

MEN-BOYS, 17 UP Steedy Work. No Layefu.





Follow this Man!

Secret Service Operator 38 is on the Job!

NOLLOW him through all the exd citement of his chase of the countertett gang. See how a crafty operator works. Telltale finger prints on the lamp stand in the murdered girl's room! The detective's cigarette case is handled by the unouspecting gangater, and a great mystery is solved. Better than fiction. It's true, every word of it. No obugation. Just send the coupon.

The Confidential Reports No. 38 Made to His Chief

And the best part of it all is this. It may open your eyes to the great future for YOU as a highly paid Finger Print Expert. More men are needed right now. This echool has taken men just like you and trained them for high official positions. This is the kind of work you would like, Days full of excitement. Bug enlaries. Rewards.

Can You Meet This Test?

Can you read and write? Are you ambitious? Would you give 30 minutes a day of your spart-time preparing yourself for this protessor? Would you like a life of excitement thrilling adventures and high pay? Answer yes and I'll show you how to attain all the.

Send the coupon and I'll send the Free Re-ports — also a wonderful illustrated book telling of the future awaiting you as a Fuger Print Expert.

T. G. COOKE, Pres.

University of Applied Science

\$920 Hempside Ave., Dept. 10-40/Chicago. IX.

Mail Coupon NOW!

University of Applied Science 1920 Sungyaide Ava. Dopt. 93-64 Chiengo, III. Gentlemen: Without any abligation whatever, countries your new fully ligative of Free Bank on Finger Pittis and year offer of a FREE mayor in Record Berrick Intelligence and the Free Fundamental Proper Print Countries.

Mens.	·
Address	

Complete List of Winners in June Picture Contest

FIRST PRIZE-4500

J. C. Southwick, Houston, Texas.

SECOND PRIZE-\$100

John H. Fisher, Los Banos, Calif.

THIRD PRIZE--\$50

E. A. Oliver, Los Angeles, Calif.

TEN SIO PRIZES

C. K. Caron, Clouderoft, New Mezico. R J Cornell, Vanderbilt Mich. Oscar Behberg, Ewen, Much. Donald G. Hughes, Sabetha, Kan. F Paulsen, Pittsburgh, Pa. Mrs. G P Reiter, Bellefonte, Pa. Mrs. C. C. Rodarty, Los Angeles, Calif. Harry R. Samuelson, Washington, D. C. George Sweeting, Wayerons, Co. Mrs. Philip L. Varney, St. Louis, Mo.

FIFTY \$5 PRIZES

E. H. Babcock, Brooklyn, N. Y., W. Cecil Baker, Chattanooga, Tenn., H. S. Barbee, Pontane, Calif., Mrs. Cecil D. Buhl, Dallas, Truss. Paul S. Ciarle, Boston, Mass O. B Corley Carterwille, Gu. L. Van W. Curtis, West Rentbury, Mass., Merchant L. Cushing, Plastow N. H., Fred. E. Davis, Lennusville Queber, Canada, J. Wesley Douglas, Lisbon Center Me Alice Howell Duphriene Sharon Springs, Kan., Laurence P. Folsom, South Royalton, Vt E Frey, Corescana, Tex., Mary F Gasbraith, East Cleveland, Olso, Mrs. Chas. Gamble. Canon City, Cal A. R Godfrey, Spokane Wash . Paul T. Hangen, Chicago, Ill. Harvey A. Hansen, Omaha, Neb.; Maude P. Harris, Webster Groves, Mo , Alvin Hille, West Consector, N. Y., C. H. Howard, Bur lington, Ontario, Canada, Edward S. Johnson, Boston, Mass. R. H. Johnson, Moline III. John M. Keenen, Denver Col. Walter H. Kelley, Buffalo, N. Y. LeRoy W. Martin, Inglewood, Calif., R. A. McGinty, Fort Collins, Col., Elmer Noble, Rome, On., Maues Incr. and Velma Ooton, Winter Haven, Fla.; Myrtle Poage, East Chicago, Ind.; A. H. Pritt, Mobile, A.a. R M S Bridgeport, Coon. H. E. Scholl, Allentown. Po Wm. H. Shoemaker, Pittsburgh, Pa., George E. Smith. Cincinnati Obio: George R Smith, Sugarcreek Ohio Chies. M P Striger Covington, Ky Lincoln. Staiger, Port Huron, Mich , Mrs. John Terry Norwalk, Okuo, Mrs. H C. Therentt, Shreveport, La., Justus W Trojann, Astoria, N. Y. Ches. Shepard Tulier, New Orleans, La., F. D. Van. Valkenburg, Kalamanoo, Mich., Barle Victor, Glendive, Munt.; Oliver M. Walker, Mt. Vernon, Ohio; B. W. Wall, Youngstown, Ohio; W. L. Waterhouse, Youngstown, Chic; W. L. Waterhouse, Youngstown, Calif.; Don E. Williams, Grand Rapids, Mich.; W. E. Wilson, Ontario, Canada; Carl Zaebet, Bucyrus, Ohio.

The names of the prize winners in our July Picture Contest will be announced in next mouth's insue.

Repeated vivisection of animals will be at least reduced by the use of the movie camera, according to a plan of French surgeons and scientists. Films showing in detail each step of an operation would make it unnecessary to sacrifice several animals for one piece of information.



Make \$50 a Week, Many of my Graduates Getting \$99, \$100 and MORE Drailing!

Dealizing in the IRC field ment. Every industry you can some to have in the dealermen. We had merhand at time age of the decounted every shop is the land would be ST sPFED. To teach you design by man, in record time

PAY AS YOU GO DON'T give me the entrance of the politic operation of the politic operation of the politic operation. I want not as interested a control of the politic operation. I want at least the men to start replat near the west them ready in restaurant of the time of any fine. We mill got a fleed of setters and engineering start among the restaurant proping good. In fact of the thin of the first of a Silester at a substantial proping good in fact of the things the offers of the first of the setter than the setter tha

GOOD POSITIONS PORITIONS have up on consider to a linearing part of the control of the control of the part of the control of the state of the state

IT'S EASY AND intermeding to learn drafting, and described the property of the second on the end for functions and all down by rules and with tipole. One of my bladenite is 64 papers and grantiser to find appears not grantiser to finish long or given up against most owniest. I grantime to finish because a floridated draftiments who can see her oppositivity and its they continued for the new terms. Such the compositivity and its they continue for our name terms.

CHIEF DRAFTSMAN DOBE 1861 Lewtonn Avenue, Chicago 191-12-48

fixed no PREE and POSTYA D to time for PREE T - 1. OFFICE pour reve book May proofs Statisticareated and material on your laster respects, better, etc.



Minter	day
Address	14
P 0	July 1989

Dyke's Automobile Encyclopedia

Locively Rewritten, Mencennicol and Misserstad Oreally Salarged. [334 Pages, 6143 Businstions. A PRACTICAL BOOK FOR BYERYBODY



Fig. Represents of \$1.00 lbs. blood back a ready reference and guala, The data Dance will

know pass to dangered transisten and have when require and dank PLOAL.

The Musical Imeration the fitted amount of property in the property of the pro

This Beek Will Trouch you to

An Errett Anteriobile Francisco but cally for feature with the feature with the feature of the feature ten bu'en different mie tions one has an eller fraces fraced on upst-on generations as the mean means observed ancientes obs. Page material and Controls will be noted. be nach

DON'T WAIT-Great New!

Clock (6-Ling American Mercata \$7.00 Protonid.

POPULAR SCIENCE MONTHLY

250 Fourth Ave.

New York City

Will You Accept a 1926 ATLAS With Maps of New Europe Webster's New

International Dictionary The Merrica The "Supreme Authority"

enquiele reference liberra in distremen bares with fill to page a territoria par mand of musticulated by a 15 or large to disposition will be a stiglio establish man must be protected to the following remarkation man taken

The settre work including the 1826 ATLAS) Delivered for \$1.00

and may must sly paymonts thereafter his Called Mares and marks to work probably production beautyful trake Capur Repton whell is

Reduced About One Half

In thickness and weight as compared with the Reguler Edition

Dear 467 000 Secularly Tarms and in milition, 12 000 Biographing hamos nearly 22 000 peopraphinal Subjects, \$000 peops, \$000 interpoption. Language plane. Language property improved and acts up to date

"Indicate this work to the horse to the arriding the whole facility to earlings. To have it is the effect to be employed the glossomer by provident shady upon topol.



Pleater would not from a copy of "Distingues Wringlan" destining an arminetic Test in Principle with help alone. With the pre-creek to those presents and alone in Paragraphs and Plane of the new bindings. Therepotes operations. purposed from and regular paper with retire of fifty of the Atlan on Wahater & New In extentional Inchesary to renders of his Magazine Alexanders of his Magazine

Hampton made TIME 17 d of in house epote time post sending this Beautiful Hand Tax ared Cap made to his Individual Menange Why but the

the same your opportunity to earn \$50- \$75 a week in your space time

Get This Cap GIVEN

I want to give on this can there I know your friends will be delighted with its these with the said bit and , as will make a generous profit satural their nities. There is no a to be and at the said their nities. There is no a want and if it will not public their their awar and if it will not public to make 350 a work in 1927 apart time. Will other the at above I W. Taylor Press. This for thap Manufacturers, Dept. P. I., Clarimani. ()

A 2c Stamp

-will start you on the road to success. See Money Making Opportunities on pages 134 to 165.

Your Home Interior

the lumber industry, and is unavoidable. How about the best grades in widths not too parrow?

Very well. Specifying clear stock, or freedom from knots and other defects. quarter march, two and one-fourth inchface with a thickness of thirteen sixteen that inch, maple heads the price list in most parts of the country at fourteen cents a square foot. White oak follows at thir teen cents, while red oak is a cent cheapey. Long leaf pine of two and three-eighths. anch face but otherwise similar is quoted at twelve cents. I would not try to save money by getting any floor material in plain sawed or flat grain, but might consider using a precond grade of quarter. sawed stock and also a nominal halfmeh thickness in the case of oak, which would reduce the price to around tencents. Speculative builders econorities by putting pesticlass flooring around the busters of a morn and second grade in the makile, where, they claim, quality would go to waste under the usus rug-

OES oak floring come in room lengths?

Fac from it, unless you pay a large prendom above the prices quoted. Many tucces are two to four feet in length. Ande from extra labor, the job is better than it might seem, because the ends of bieces are tongue-and-grooved as well as the sides. Hand nailing every foot or so with cement control made is advised. Modern oak flooring is concave beneath, or hollowed out in the back. This tends to prevent warping. As a further precantion against misbehavior of the wood, the floor should not be laid tight to the walls but given a half inch of space at the edges, which will be covered by buseboard molding. An oak floor calls for machine semping, followed by anadpaper, after which it is ready for a paste filler of desired shade. The plainest treatment dispenses with filler and in a dressing with special floor oil. Otherwise, a was or varush surface in applied after the poste blue.

HOW does maple compare with oak? Since at commands a higher price and is used for the floors of public ball. rooms, you may gones its quality. It is a fact surprising to most people that maple is considerably harder than oak and will therefore stand more wear Thus statement is based on tests at the U. S. Forest Products Laboratory at Madason, Wis. We are speaking of the variety termed hard, rock or augar maple. —from which maple sugar is derived—not sto weak relative, silver, white or soft ma ple.

What about the long leaf pine that you mentioned?

The first grade, quarter sawed, alian nit sawn, edge or comb grain, is very satisfactory. It has the advantage, labor saving and otherwise desirable, of coming in full room lengths. And such length is uncidental proof that the flooring is derived from the tall trees of long leaf pine instead of from other species. If feasible, it is ad- (Continued on page 160)



Student Receives 250 For a Few Cartoons'

THE Washington School of Carton ing A quality prepared you far the highly pa Pield of eart on ng. And when we say bigoly paid we been just that! has a are facts. Money talks. And here a prooff Just read this "straight from the shoulder" letter.

The enclosed cartoons," says O. A. Pokrandt, a Wisconnin atudent, samples of not progress in drawing. I have received \$250 for those and the enchood le ter will above that I have a reads macket for my work in the future. The making of cartains has been not round of pressure and copyment as well as profitable to me."

Cartooning Pays Big

There's no more attractive or highly poid profession today than Cartonning Millions of dollars are spent every year on eart some. Capable cartesmats cara from \$ 50 to \$250 a week. At I now you for any learn to draw side-spotting contenright at bothe in space this through that method that has already been tested and proved to many Musicipus Served Graduates. No talent or traiting peeded. No broughty. And in a very most Openson. should be ready for one of these pleasant, lug money exctonuest a journ

Send For FREE Book

A new handsomely illustrated back has just been printed, which gives all the most up-to-date information on the thousands of wonderful opportunities in Commercial Let and shows how this startling method easily enables you to enter this field. It tells all about our students—their success -what they my-actual reproductions of their work how they made quick profits while studying. This attractive book will be sent without cost or chagatum Bend for it. Mad coupon NOW. Washington School of Cartooning, Room 2411-D, 1113-15th St., N W., Washington, D. C.

******* Washington School of Cartooning. Reem Mit.D. 1813 thin Sc. N W. Washington, D.C., Please send me without obligation, your illustrated FREE BOOKLET OR Carbonning

Name (Write Name Plainly) State whether Mr. Miss of Mrs. Address

Chy

If under 26 years, please state age.



Astonish Your Friend

Gain that magnetic popularity that makes you the center of any crowd. Business and social success is assured the man who can perform mystifying tricks. You can earn big money either on the side or as a professional, as well as being the most popular person in your crowd. Why envy others' skill? You can learn Magic yourself, quick and enty.

Earn Up to \$1000 a Month

Even siright-of-hand, generally supposed to require long practices, to NOW made aimpic to fears. For Dr. Harian Tarbell, one of the resily Great Magicians, has finally opened up the secrets of the profession in a completely allowated course offered at a merciy nominal cost. Through the wanderful Tarbell System you will be able to mystify and entiretain your friends with simple tracks taught in your very that issues. After that Dr. Harian Tarbell takes you through the untire mase of sleight of hand card tracks and elaborate stage directionments. The apparently superhuman doings of the accomplished magazian becomes an aimple as ABC when you just know how.

Mail Coupon Special Offer!

There is a trappendous demand for magic entertainment. Clubs, Lodges, Charity and Social affairs—all will pay high fees to the man who knows Magic. Dr Harten Ferbell really gets as high as \$250 for a half bour's work right now. Opportunity everywhere to make money saids from your regular occupation, Salesman find it a transcoton sees. Find out all about this unprecedented opportunity to searn Magic. The coupen brings full details without any obligation, Mad R TODAY,

Tarbell System, Inc. 1976 Suppyside Ave., Studio 13-58 Chicago

Tarbell System, Inc. 1914 Sunnyelle Ave., Studie 13-44 Chicago
Tell me ad about Dr. Turbell's new and simple system by which I can learn the secrets of MAGIC. No obligation on my part.
Name

Your Home Interior

(Centinual from year, 18th

vised to run this flooring continuously through doorways, omitting the usual threshold strip or door saidle. Ends of the material are not tongue-and-gruoved. as with oak, so that the ends must be carefully fitted. At tenanch intervals eightpenny ateel flooring nada should be blind-driven at a forty-five degree dant. Blind or secret driven means a nail put in just above the tongue, its head being concealed by the lapped groove of the next strip of floor. Each strip should be forced to a tight fit against its neighbor by hammering against a bit of grooved stock that protects the longue of the placed strip.

HOW can I be sure I am getting the genuine article in pine"

Length, reddish rolor rather than yellow, freedom from knots and flaws, grain in fine parallel base minning angthwise of stock. The manufacturer's mark may be a guarantee, and the word of a reliable dealer is worth having. We must note there is some dimensional variation between different woods as manufactured, though the nominal sizing may be alike, and that gradings differ, as clear, sap clear and select for oak, while southern pine grades as A. B. C. D. foltowed by common. Clear in oak and A in june are tognately,

What is the finish for a southern pine flator?

It is scraped by hand or machine some hand work in nawnys needed at edges and corners sandpapered and dusted off. Then apply two coats of variable made specially for floors. These who do not care for the high gloss that results may tone it down with floor wax applied with a weighted brush. Another treatment, which is not so well recommended, is two cours of shellar instead of variable, followed by floor wax. Oil stams are sometimes used. It is assumed that paste filler is not required for a tightly laid floor. Whatever the finish, a floor should never be mopped at acrabbed. with water. Wipe with a damp cloth minediately taking up mouture with a dry rag. About once a month clean the floor by witing with a mixture of sweet on turpenture and vinegar, in equal parts, which will restore the original

What are the desirable points in interior (from?)

TRST that the lumber is quarter sawed at least three-fourths meh thick, without knots or flaws. You must decide between softwood and hardwood, also between material that is naturally resistant to decay and other kinds that must be well protected by paint or else. Trade terms are misleading, since "hard wood" as name used to include some of the soft at lumher, such as chestnut, basswood, cottonwood, rellow poplar. If you want really hard wood that will resist wear, dents and stratches, take oak, maple or burch. The latter is well qualified to be in such compuny, for while it is the merest trifle softer than white oak it excels red oak. Southern pine (Continued on page 161)

Practical educators for Said all Engineers, Firemen, Machinista, Electricions and engineer students. Eight valuable, up-todate Guides treating on the theory and practice ng weeting in of missenni Burks GFBDCLE



A COMPLETE HOME STUDY COURSE AND REFERENCE LIBRARY Apricket numbers with Heady Reference Lines 87 d pages, 4500 Bustrations Easy

index 87 d pages, of the flustrations Easy to read I bathly endorsed A good below sections Engines a Larence Price L2, when a special particular to your Questions and Problems. Answers to your Questions and Problems. Here is a particular of the subjects covered to Engine Principles, Volve Setting, Pumpa, Cerlins Engines, Uniffer Engines, Localmotives, Marines Engines, Turbina Engines, Castacters Engines, Localmotives, Marines Engines, Turbina Engines, Castacters, Engines, Localmotives, Marines Engines, Turbina Engines, Castacters, Engines, Construction, First Common, Boller Construction, First Const

SHIPPED FREE

Not a cent to pay until you see the bioles. Mo obligation to buy united you are astrafted. Fith in coupon in secold. Send now-today—neights standard library for Engineers and Merhanics.

FREE The Land Ca. 65W 21St M.Y Chy
wid mie Al Bills Englishers
AND MECHANICS GUIDES 6 COUPON unmbers, \$12, for free statementalism, if satisfactory, I will send you \$1 in 7 days, these \$1 monthly intil \$12 is paid.

Number of the state of the stat	
Address	
Droupation	
Employed by	9134



Learn to Draw at Home

Simple Method Makes It Amazingly Easy

Trained artists cuts from \$50 to over \$200 a week. storted us demand right now for great art work. Magnitude the wegation is sufficient them before ing brackers.

Persons an artist theough this quick may method eight at home to space time. Langua Bloomating. Testen ing and a new long Artist for learning this way formal action to the first to surround the first and artist art in a register. Langua to draw and care hig money.

Send for FREE BOOK

Jose product a best book which describes the latest developments and wroderful appearanceises in Commercial Art and gives full default of the quick rowy method of textising to draw. Tells all about our acidebid there were near with they any accurate reproductions of a give work — and how many carned big mobile they at a give work — and how many carned big mobile even while learning. Write for this live Book and details of our Attractive Offer Man postumi of lever new

WASHINGTON SCHOOL OF ART Remain B, 1116-15th St., N. W., Washington, D. C.



Learn Practical Aviation at Home

and Get Big Pay—Yes! \$75.00 to \$200.00 Weekly Is Being Mudel

Aviation is the becoming industry-growing by leaps and bounds. Men needed in every arm of the service. Five tames as many men needed today in Peacural Aviation, in arreading and building, as we paluting. We teach you Practical Aviation at home

LEARN WHILE YOU EARN

Our course is one of the most complete and thurough ever published; directed by aviators who have flown hundreds of thousands of miles. They write it is way that you will understand, and you will great the full meaning of everything about an airplane; how it flies; constructuo; airplane engineering' maintenance. Our course is the foundation work for everyone who aspires to get into axistion. Lessons-drawings-questions easily mastered by anyone who can read

Our easy payment plan aids you. We help you get a position. MONEY BACK GUARANTEE if not entired Rest-blooded men of action are getting into Avintan and guilang money

WRITE

For FREE [thustrated Poider

It telmahout the United States School of Aeromution and bow they can help you get thto avaition.

Write to Dept. B

United States SCHOOL # AERONAUTICS

MAYWOOD, ILLINOIS Near the Chicago Air Mail Terminal Field

HUNDREDS OF AGENTS

Nev adjusts in the tire makes I co-cape it and here to an ly A perfect it abrade its emappy at termine extra-binations. It was hand tasking work-mentary American law price. I say man and other state beauty of those type at abrades All together take or bers. So supported to be a supported to the support in a perfect to be a supported to the s

Selling Outfit FREE Handreife a intern mabe # .th a mark districting that F. A quantible eamplein elling name tracely

No a numerous place of the FITS-UCAP CO Dest T-81 Continent O



Your Home Interior

(Contrared from page 100)

ranks next in hardness, and is very mentorsous in quarter cawed form.

Which are the decay-resistant soft would for interior trout?

White pine, western or sugar pine chestnut, cypress, redwood and spruce The two latter are not welely available Redwood is a standby as to native region away the Parity road. Besides resisting decay these materials do not easily worp. which is mother point in their favor Other woods, unless handled with care now become twisted out of shape even before they are put into your house. A region of dampoem and masonry walls that sweat or condense mossture mude are conditions that especially call for lumber of natural longevity. Point or enamel protects the exposed surface of tren but not the hidden under side

And what are the other woods for trum?

B 188WOOD or wintewood, which shares the latter name with yellow poplar or tulip tree, and American grimwood which is better known as red or sweet gum. These three varieties take point well and are often given a luxurious finish of white enamel. Gumwood that happens to be figured or of an interesting texture is properly treated with a natural finish that brings out group and pattern beauty. The enamel process takes much time and patience, since five coats are applied, each left to dry and then hand rubbed. Fine sandpaper is used except for the last cost. which is rubbed to a dull finish with namice atone and water. An enamel air face is handsome and, being easy to keep clean, saves work for the homekeeper

Where can I get full details on finishes and some points on interior decoration.

including audable colors?

Ask your lumber dealer for literature Some of it is quite unliased. Check up on partisan claims by reference to the mformation given in this article.

Chick's Eyes, Taken from Egg. Keep On Growing

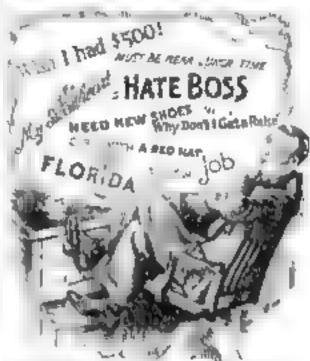
EAS taken from the embryo of a checken and planted in a culture medium were found to grow and develop unite normally according to reports of an experiment recently conducted before members of the Royal Somety in England.

The eyes were removed from the couhevo after the egg had been incubated for a period of seventy hours. An extractof the embryome tissue and the blood plasma of fowls composed the medium in which the eyes were planted.

A HOLE MEACHING more than a mile and a half into the earth has established a new world's record in oil well drilling near San Diego, Calif. The new well is the first to be drilled more than 6,000 feet with electric power. The drill ing will be kept up, say the engageers in charge, as long as it proves practicable oil appeared at 3600 feet, but the tests unproved farther down, so the engineers kept on drilling.

Scatter-brained!

No wonder he never accomplished anything worthwhile!



His made is a hodge-podge of the lakest forms of make make make the property and any of these betterns about any of these

Though a finch is a and eat of the train with the spend of ghoung New Means and a per-met a consider out old mean before they have about form or shape.

the in Scotter Bestment

He resident to he done per pland. He remark wide and may office, with too shiftly, place bits in the prospects person.

the stime bimed' excuses himself, appropriation with between the transity in the heat supervision of the heat supervision for all general arguments, ariginally, around the term most time.

If a resulting an that his down both know how the same him before. If a many had removed passels are overnanting

There are collings the him things half envenions -

I to a standard fact they because of the speciment constraint of the standard factor of the standard standard stan

Worst can be done about 11.5

blied and he means of framewhen then decides the period for the pe

Polargements in the orience of appoint participate which the arrest for world in the better of a religion 1 began a small power of a roll is that all over to morely, see that their threaten that presented

Among those who advoca e l'elevantes ara:

and altered of ugahi prominences, the numerous of

P O'Conner Pather Jerome K Jerome, Newl-of the House of Com. (a)

The time Six H Liston
Hedge ed. Foresuch
Covered Sir Hadden
Powell Founder of the
Bu Scaue Mertween I
Judge Rea B Liston
Fresh F Walsh Formus
Under the Jare
Interest Dense
Thairman of Sustance
Thairman of Sustance
War Labor Board
War Labor Board
Thairman of Sustance
Thairman of Sus Gan Ste Preducirit Maurice Director of Military Operations, Imperial General Staff.

ment live here

to represent the branch replied. Perhans for M. and Trauming has been up to allow the formation. It also be the minuted form. Note the minuted form that the model the model the branch to be a trained for the model the branch to be a formation of the formation of the model the branch to be a formation of the for

the you are made of he state that len't destroit to read to a date from his a seen my last so lessing to the set of the seen my last so lessing to the set of the seen to be seen as the seen seen seen to be see

The Bias principle of your encours is in do something define and it has examine aftern to require the define and it has determine and the test according to the desire and the test according to the test accord

THE PELMAN INSTITUTE OF AMERICA Approximate a programming the excitant optifier the large of the man of their horse hard to be the total option to the second of the second option to the second option of the second option option of the second option op 14 West tith St The Felman Inviture of America 19 West 46th St., Suite 6711, New York City.

I want you to show one what Primanism but actually done for over 550 PM people. Please sand my your free book. Strengthe Mind Training." This places me mades no obligation whatever

Address

City

Stage



NJOY the aights and wenders of New York the modern dag lad at the same time you are learning exetracity.

Be An Electrical Expert

Graduative of the NEW YORK ELECTRICAL SCHOOL are in demand by all the to elect real school are in demand by all the to elect real business for if you prefer the adependence of a business of your sets. There are the mention of opens turn treatment, dependently men to become also; thus countries for efficient, dependently men to become also; thus countries are Where you are your wante-a the money you can make to limited only by your own manage and ability.

Personal Instruction

The NEW YORK STRUTTRICAL SCHOOL is not a correspondence solved. You been by decay—by personal mets action on full size standard electric estings queent under the personal aspersacion of bouned instructors

At N. Y. E. S. you train your hands and mind at the mans thou. You learn the there is of electricity and then you are shown low to put the theories into a use practice by entring the problems with your own hands.

The man who has learned electricity by actually doing electrical work under intelligent personal restruction sale go to any park of the world and be sure of a read fiving. There are N. Y. E. S. C. adulties in all the rountries of the world.

Write today for the 48-page booklet giving full infortunition about the N. Y. E. S. Course and obserting persures of the equipment semilable for your personal use in our two seven-story buildings.

The NEW YORK ELECTRICAL SCHOOL 40 W. 17th Street, New York

THE NEW YORK ELECTRICAL SCHOOL 60 W 1746 Street, New York.

Please send me FREE your 48-page booklet It is understood that then request puts me under no obligation.

Name.

Address.

Oueer Pranks the Moon Plays

(Continued from page 30)

and discomfort. Science believes that conditions among other smun aper are about the same as among gibbons, and that there is a set of error, instinctively developed and the same in all, conveying comfort, discomfort and various desires, threats and fears. The mankeys help these sounds with gestures and by making faces.

SO IN a sense, mankeys do talk, says Professor Wilder, of Smith College, in his book, The Pedigree of the Human Roce. Professor Wilder also points out that babies exhibit many characteristics extraordinardy similar to monkeys.

A halis will hold its feet adways with soles faring downward and inward, he says, and will always come to rest with the sides applied to each other. When a baby first tries to walk six feet roll over mward. These, says Professor Wilder. are applike characteristics.

"Among primitive people," he continues, "we find a natural acceptance of their kinship with other animals. Especially does the distinction between menand other animals disappear in the countries inhalated by the great man-apea.

Everywhere in such places these great aper are considered to be simply wild ment are denominated as such in the native language, and appear thus in the local folklore and popular stories."

"The Practice of Organized Play"

By Bowen and Markell Published by A. S. Barnes and Co.

"Education Through Physical Education"

By Igner S. Wayman Published by Lea and Febrger

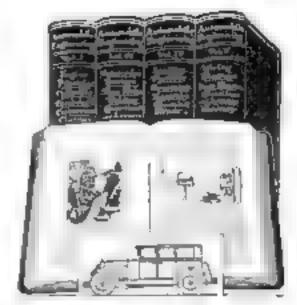
HOW near do you come to being an athlete? Well, to answer it one way, if you can do the following things you would qualify for membership in bigins Delta Psi, the honorary athletic fraterroly

Run 100 yards in 111 a seconds; do the 200 vard low hardles in \$1 accords; do a running high jump of 5 feet and a running broad of 17 feet; pole vault 8 feet 6 inches; throw a baseball 250 feet on the fly and kick a football 40 yards. swim 100 yards in I minute 15 seconds. and can two index in 12 minutes 13 seconds.

And here is what a college gorl should be able to do to be pronounced an athlete

Do a running high jump of 4 feet 8 inches; throw a busketball 76 to 80 feet. run 25 yards in 3.1 seconds; go over a buck 5 feet 5 mches high; and do a forward roll, backward roll, head stand, hand stand, cart wheel and hand spring!

SCIENTIFIC methods are being ap-plied more and more to finding out just what students can and should do in the way of physical strength. According to the authors of these two books, there will moon be a universal "physical quotrent," just as there is an intelligence quotient, to serve as an accepted standard by which to judge ourselves and see how physically efficient we really are.



Can You

Repair any an a faul learn how NOW You can do a quantification from a replication to the manufacture of the strength of the property of the strength of the property of the strength of the st

"NO MONEY" OFFER

As invarions more plants of allower instrume technique a bear booking or one for exhibit the only with our plants of any entry to the interfer to the first date. As it is present of a major at a property of a present of a part of a first between the course of a first plants of a part of the or of plants of a part o

Consulting Membership—FREE

The transfer of the same of th

American Technical Society Automobile Disisten A 826 Chicago, (Macia You may seem the our best committee throughtee Engineers to there is the same through the man had been a subject to the same through the same

Address

Cate.

Stude.

References

The Electrician's Wiring Manual

By F E. Sangatock, E. E.

Contains all the information needed for the proper installation of lighting and power sys-1rms in bousing and other busldings.

It completely covers inside electrical wiring and construction in accordance with the Nationa, Electric Code.

Prochet size- Analyle binding 448 pp. Price \$2.50

POPULAR SCIENCE MONTHLY 250 Fourth Ave. New York City



\$2500 REWARD

For the Capture of An Unknown Man

WICE be had entered the St. Clair Mansion. What was he after? Who? What was in dauger?

Berteau, the famous detective, had warned St. Clair that the mysterious margader would come again. And now - a noise in the passage! The creak of an opening door. A shot in the dark! A capture!

Is this wounded stranger the mysterious in-truder? Who could tail? Yet Berteau identi-fied the man without hesitation and won the \$2500 reward.

How did he do it? Rasy arough for the Pinger Print Expert. He is the aperialist, the leader, the cross of detectives. Every day's paper talls of their windowful exploits in nothing mysterious crimes and convicting dangerous

More Trained Men Needed

The demand for trained men by governments, elates, cities, detective agencies, corporations, and private bureaus is becoming greater every day. Here is a real opportunity for YOU? Can you imagine a more functioning one of work than thus? Often life and death depend on finger print evidence—and big rewards go to the export Many experts earn requisity from \$3,000 to \$10,000 per year

Learn at Home in Spare Time

And now you can learn the secrets of this acience at home in your spare time. Any man with common school education and average phility can become a Pingar Print Detactive in surprisingly short time.

Free Course in Secret Service

For a limited time we are enacting this special offer of a Professional Pinger Print Out-AL absolutely Press, and Press Course in Sevet Service Intelligence. Mastery has two kindred professions will open a builtart except for you. Write and thy for fully thousand free count, on Pinger Prints which as a beat until this poler has ended would the to line Write at ones address

University of Applied Science Dept. 13-63, 1920 Sunnyable Ave., Chicago, 416.

UNIVERSITY OF APPLIED BUIENCE Dept. 13-64, 2939 Sugmyside Ave., Chicago, Ill-

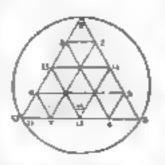
Continues: - Without any notice on whatever again me your new fully lifter as of FRFF book on Flugge Print a new just offer of a Fitty contract. In Secretary service in editioner and the Free Professional Spage Print 429 fit

Address

Answers to the Sam Loyd Tests on Page 51

The Fourteen Strokes

Starting at 1 in the design as shown at right. and stroking toward the succeeduig numbers in their order, you can trace the complete figure to 14 strokes, the circle



counting as one. The space between I and 15 is gone over twice and the continnous line crosses itself at several points. as permitted by the conditions. From 10 to H is the circle stroke

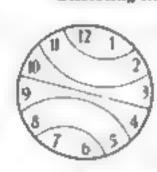
If you found this solution with a 14 tunutes, your rating is good

The Baskets of Eggs

The basket of 29 eggs is the one the grocer figured on willing, for that left a total of 00 eggs in the other buskets. Two thirds of this remainder, 40, must have been hen eggs. The 40 are contained in the makets marked 23, 12 and 5.

If you discovered this within 11 minutes. you rate high at mental arithmetic

Dissecting the Clock Dial

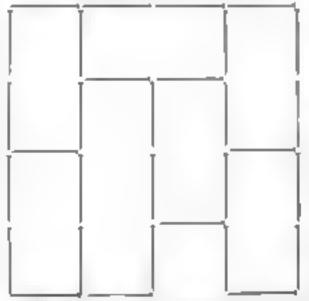


Here is how the clock dial may be divided suto aix parts, each contacts. ing numbers totaling 13. You should have done this in four minutes, to prove you have a head for figures.

The Yowel Sentence

"I nwe you" in the sentence that may be constructed from the a. e. i. o. ii w and y Ten minutes gives a good rating.

Breaking Up the Squares



Nine time must be removed to break up the 30 squares. If you did this within ten nunutra you cate high.

Straightening Out the Sandwich Men.

Rearranged, the aunouncement reads

SALE NOW COING ON

If you straightened out the max-up within four moutes, you have a good rating.





Big Stage

Master Musican from Master Illustons from Burone, India, China, Iapan — Guarded ercrets of the Orient — Over 150 tricks from amall effects to this Stage Illusions, nearly 1500 illustrations— that and more is what you get in the Tarbell Course in Magic.

Secrets of the Orient

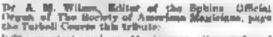
Yes, those great invotories the Hindu guarda no training and famous Magicians have ruled their lives to secure—these and MORE are YOURS in the great Tarbell Course. Many

a mystery here is worth many times the whole cost of the entirecourse.

"Patter"

Ringielane will tell pay that finite r the name for the entertaining and diverting talk be given to highly lin-portent. The Tacked I some given how you pro-feededtal. "Pattern"

Read an Great Endorsement



and Only Course in Magle

public touching Bent Professional MAGIC

The First Stage por attempted and your stage as eyech as the first the bridge property that the first the bridge for the first the bridge for the first graden, by sore ago."

Money - Back Guarantee Protects YOU

The great Turbell Couragin Manie protects you set is no from Clark Couragins to the Tourage from the first protect if you are not set issued from You have procepticing to gain.

Get Started on the Road to Big Money •

You need not give up pour job. You don't have to be a professional in make his receive. You may make note money entertaining on the side no a nemi-perifectational, or if you was to you can become a hig stagman make his money and excise fame and glory Learn of the greet limited apportunities in stars for you. May Coupen NOW!

Tarbeli System, Inc.

	1920	Same	Suide					Chicar	
E	100	(i) + (ii) - (ii)	Jakin 🐨	HIT of	100	े व	نۍ د		

١.	И	La	10u		ı n	12:		TY	94	٧:
9	r	rin	40 8	yste	int, I	DC.				
1	100	20 2		y stele	Ave	, Str	idle (18-68	Chile	agr
								nd Hm		
-	rie.	April	et pro	of Gra	ret Sp	restari	Price	Office.	MONEY.	
	Pag	The state of	1 Plu	a. No	i obiu	re bloo	PR 20	dr pert		

No.	-
Address of the Control of the Contro	



HIGH SCHOOL COURSE IN TWO YEARS

YOU AM BADLY If you lack MANDICAPPED High School training.

You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

BIG PUTURE This course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, siert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and meets all requirements of a High School training. From the first lesson to the last you are carefully examined and coached,

USE SPARETIMEORLY

Most people fells away felly bourn a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present hundicap within has years. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

Check and mall the groupou NOW for full particulars and Free Bulletin.

American School Burk H-875, Great Are, and 199, St., School

American School

Dept. H-875. Drawd Ave. & 58th R., Chings Send me full information on the subject checkel. and how you will help me win success.

- Architect
Building Contractor
Astonobile Engineer
Civil Kagmer
Buructuras Englange
Smitten Manager
Cort Public Arcountment
Accression to the Amilian
Bookkespar
Draftman and Dudgeof
Chetrical Engineer
Electric Light & Power
General Edwardson
Consideral Districtions

A wrote the product of the product of the proper section of the product of the pr

Fame

When Coroon Clogs Your Motor-

(Continued from page 62)

"Somebody told me you were going to put in a carbon burning outlit—" he began, and then he spotted the new apparatus. "I see you have it already I want this motor burned out right away It's just loaded with carbon. Can you fix me up?"

"Sure I can," replied Gus, "but not by hurning out the curbon. From the way that motor is running there is a whole lot wrong beside too much carbon, and it would still run rotten even if I did give it a burning out."

"It's that so?" growled old Burdett.
"It's the carbon that's making it run rotten. I tell you, and if you burn that out I'm sure it will be all right."

"But burning the carbon only cleans out the clylinders," Gus protested, "Your valves are sticking because there is carbon caked on the stems, and the oxygen doesn't cure that trouble at all. And if the valves have been sticking for any length of time they're sure to be putted bad enough to need regrowing.

"Bunks out the carbon is worth who all right. For your motor, the best way will be to take off the cylinder head, scrape out the carbon by hand and grand the valves, paying special attention to getting the caked carbon off the stems."

"Yes, and you it want about a redson dollars to do that job, "mapped Burdett

"I grew I il do it myself.

"It isn't very difficult even if it does take time and gets your hands dirty. You don't even need any special tools except a valve lifter and some grinding compound. And we have a valve lifter in stock that will only cost you the price of burning two cylinders."

The pies seemed to appeal to Burdett, for he went into the office with Joe and came back in a few minutes with a pack-

age under his atti-

"How do I get started?" he asked

"First draw the radiator—fore told him. "Then take off the top hose counce-tion, the one that goes to the cylinder head. Your motor has the valves at the side and that means that both the intake and exhaust mandolds are botted to the exhaust block. If you had an overhead valve motor you would have to take them off too.

AFTER that get out the wrenches and loosen up all the cylinder head bolts about two or three turns. Then step on the self-starter and let the motor turn over a few times. The compression will loosen up the head if it happens to be stuck tight. Get busy with the wrench again and take out all the spark plugs and the cylinder head off."

"Isn't st pretty heavy?" Burdett asked.
"You can lift it easily enough," replied
Gas. "You see it is all hollowed out for
the cooling water so it's not nearly so

beavy as it looks.
"Scrape all the carbon out of the cylinder head with an old screw driver. Then strape off the top of the pastons,

one after the other and be sure to cover up the holt holes and the cylinders you are not working on to keep the scrapings from clogging things up.

Gus continued as he took off the parte on the sale of the motor and showed Burdett how to use the valve lifter. 'Watch out you don't lose the pass and be extra careful not to mor up the valves. They all sook alike, but the exhaust valves on this car and on some other makes are made of tougher material than the intake valves, and if you get them switched award the motor will run right for about a week and then the muphaced valves start to warp and you will have to do the job of grinding them all over again.

DON'T use too much granding compound and don't press too hard on
the valves, and you will find that the waterfloated granding compound Joe sold you
will do a fine job in no time at all. Be
sure to get all the caking off the valve
stems and pound them as bright as
possible

Barnett Intraced off faled with eathu-

masm to start the job.

Hun's grunted los after he had gone
"I suppose he thinks we guarantee the
job just because you gave him a few
instructions. Why stidy t you argue him
into letting you do it?"

Those tworry Consgruned. "Burdett hates to get his hands diety and after he has spent about a week trying to get the dirt off 'em from that job, he il come around the next time and let us do it."

Heat Changes Paints' Color

That proofs made with double before and receive and mercury undergo a change of color when heated, returning to the original abade when cool, is the reported result of recent experiments in General Electrolationatories. The copper and increasing to dark brown at 100 degrees and to black at boiling temperature. The other is ordinary veltage and to dark brown at 100 degrees and to black at boiling temperature. The other is ordinary veltage and to dark brown at the dark orange or brock red

Among the uses suggested for these paints is coating machinery parts which are apt to become overheated. Applied to bot water tanks, the level attained by hot water would be indicated by the

changed color-

THE HOUNEWIPE who has the rost scraped from the inside of the hot water heater may soon find it leaking, because the accumulation of rust has really been acting as a protection.

A wan Gas has found a peace time use in the silk industry, according to reports from France. Silk coccous are now being gassed by small quantities of chlorospecius, the new method baying marked advantages, it is suit over killing the economic by baking or streaming.

Here Are Correct Answers to Questions on Page 52

1. If we include Alaska, the highest morntain is Mount McKinley in that territory. It is 20,300 feet high. In the United States proper the highest mountain is Mount Whitney in California, 14,501 feet n.gls.

Approximately 980,000,000 acres, or a little less than 20 percent of the entire area of the United States, are now forested. The forest area was once more than twice an great as thus, built of it haveng been cut

3. There are two such places the North Pole and the South Pole, Time ordinarily is measured by the rotation of the earth, as indicated by the rising and setting of the stars and other heaverly bodies. At the Poles the stars merely appear to revolve around the heavens. When it is madeight, for example, at the mendian of Washington on one side of the Pote it would be noon at the opposite merchan only a few feet away?

4. This is true of Mexico City capital of Mexico. This city occupies the agte of the apprent capital of the Artees, and a built in on metased valley. At one time the bottom, where the city now stands, was covered by a lake. Dikes and drainings ayatems prevent the city from

being floorled.

5. Ladoubledly it is the Gulf Stream, which is a yaot and continuous correct flowing out of the Caribbean Sea between Florida and Cuba. From here the Gulf Stream flows poetheast across the Atjuntic Ocean. The water of the stream is relatively warm and it remains, therefore, on top of the occurs.

6. The axis of the earth is trited somewhat with reference to the place in which the earth's orbit ses. Accordingly as the earth moves around the sun, first the northern hemisphere is pointed toward the sup for half a year and then the southern hemsphere for the other half. The seasome of the southern beganghere are exactly opposite to those of the northern

7. It is probable that the chief reason for the lumous fags over London is coalsmoke. The log does not commit of smoke, but the millions of tray particles in the smoke serve as centers upon which drops

of water condense.

8. This is a custom that was invented many conturies ago by the farmers of a Syma and Arabia. It survives nowadays m Morocco, Africa. The object is to keep off the man.

9. They were built as monuments for the great kings of ancient Egypt.

The deepest place known at present. was discovered in 1924 by a Japanese ship. just off the coast of Japan, about 150 miles southeast of Tokio. The depth at this point is 39,636 feet.

II. There is small doubt that this distingtion belongs to the famous beach of Waikird, in the Hawanan Islands.

12. This method is used in the pineappre plantations of the Hawanan Islands. before it is time for the pineapple plants to come up, the planters lay sheets of paper on the ground. The sharp pineapple shoot punches its way through the paper and comes out. Means hile the weeds are discouraged from growing.

Vew Low Price

for the greatest source of complete up-to-date information on all subjects

Now, at a price never before possible, you may enby this limitless afore of intensely interesting, nutherine residing this wast fund of dependable instantly accessible information on all subjects of lasting importance. For a new edition is now ready, priced so low that every one may easily own the work that is recognized as starting ingliest in scope accuracy elearness of treatment convenience of arrangement, at I quiptest shed authority. The regular 2s visume edition is still avoi able for those who prefer it. But we can now also offer you

The New Popular-Priced Edition of

THE NEW INTERNATIONAL **ENCYCLOPAEDIA**



This new edition is printed from the same plates and is identical in every way with the regular eartion on to remit as text that revious, page suo, and the recent Supplement which brings the work right up to the present. But it is bound in 13 volumes instead of 25 and has been made in a large edition and with careful economies in manufacture that permit an

power seducation in to the burneling the great Attached at 1 day a Live be stell of ten by east the year. Techniques mant have The are lived in the The areas to make tely partingers.

Cloud ideal & Co. toc., 449 Fourth Ave New York and full interpretation and for each people of parties and full interpretation and for the New Popular Period Parties and full interpretation from Popular Period Parties and for each special property of the New Popular Period Parties and for each special property (Popular New Monthly Co.)

Name



and purhapers as tra-due to the lack of recess time and adjusting persons to make er a trade wonder what to get into quickly and make the most out of Having may need the very thing you are look or no? 66 55 Moser graduates know Madern Crimeter is rest to bear quick to sain, clean and FA TNATING! FIND O'T! Write clean and FA for entaking C-11

Address the branch of the MOLER STSTEM OF COLLEGES BORIES - ON (Street Address unt angligt)

Chicago, Itt.
New York N. T.
St Louis Ma.
Kannan Lity Mo.
Cincidnati, Ohio Cleveland Ohlo Detroit Mich. Deaver I alo. New Orleans La. Denaha, Nela.

Farto, N. D. Milwauker Wis. At anta Go. Memphis Teno-Dall as Tex. Resorted Tex. San Angualo. Sentific Wash. Tacama, Wash.



Complete Conservatory Course by Meil

FREE

A Descriptive

Booklet

Mall the annual for an interesting 20-page booklet containing numps in
full colurn, and many
sample full-page fluotro ions. Specimen pages
from articles on Nastelent, Emerson A chie dogo Tatair Sanka, Combustion Engines Standcasting and heavy other
an perta, of h shutter to

an jeets, of a minimum to be Control of Read-ing and Study. Together

with information about the easy terms of phyment.

Mall the anapon for an

Any lostroment of court of the formal of the court of the

ny 1930 Divided by any armin bours of his hose a de bodin Cornel Marine - an of man or flee 19 pen he we had see hit his A CALARA REMINIONS Belowykyfigigapiya Openwertyry, 335 Angel myer: Mag. Chinage



Worrying About Your Job 3nd Future

Hent be estimed with ordinary low-paid jobs that get you newlesse—that you can lose by a sikes. lookouts and lay its If you are an American critism. 185 m and, some support a several country of the State of the pand positions

Let be train you to puse the U.S. Civil Service bearanced to with ough reveing so you will be engine for one of the first appear ments o Ranway Mada, Cantorna, Internal Revenue Departmental In-nugration, Postmester Post Office and Rural and other branches. Hundreds of successful Atudents. I was a Secretary and Secretary Examiner for eight years. Write for 45-page free book. Tells all. Send (hostal now (n

Arthur R. Patterson, Print, Patterson Gril Service School 1611 Wisner Building, Rochester, N. Y.

CONTENTS



New Offer ~ Learn to play a Wurlilzer

Bill Carola, La tadana's Seremaders

couldn't play

96 pt 20 ft 40 mm - a - mm - a

If you can hum a tune you can learn to pay You are always popularplay a musical instrument. Our new offer makes learning easy. With each

When or instrument we now offer a special free scholarship for less se it on a hatamatic to to as scholarship has tanget thought a by bear tanget theorems to be been at by me that Many for a second state at grade animals at grade animals and animals animals and animals and animals and animals and animals ani

FREE TRIAL Easy Payments

ser by now have any Wurldser. ry seal for free home that are or the metrument note the nothermorehip the full rich not represelly how easy to low the peaks this is eval. arranged to must

Send for FREE BOOK

CARROLD DAY DAY IN

greatest musical estates and see except his me makes a many of them shows in the many of them shown in the many of the ma



Accept this liberal Free Offer. Learn to play the easecst way on the finest inatruments made. Our big book and specal literature tells you everythinganswers every question.

Send this Coupon

The Rudolph Werlitzer Co. (Sept | 170) 9 117 E Fourth St , Cincinnati J29 5, Websah Ave Chicago 126 W 42nd St., New York 200 Stockton St., San Francisco Send me your Free Book on Musical Instruments. Also your a Free Trial Easy Payment Plan and Special Free Scholarship offer Vo obligating.

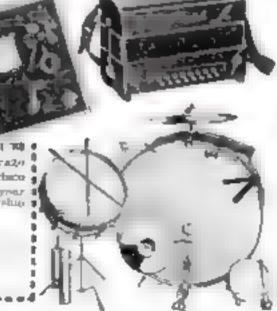
Instrument.

Name :

Address City

Copyright 1926 The Rudolph Wurlitson (

Stat







Thie One

KFGA-TL5-6X5X



Over 2,000 items—from the most beautiful, fully equipped console model radio and down to the smallest part or tool for the set builder—kits, parts, and supplies of every contentable type and style. All beautifully illustrated and interestingly described. And to give this book added value, we have included radio data that makes it as invaluable text most for every lover of today's most fascinating and most wonderful achievement—RADIO.

Radio Sets

In this great radio market place you will all those model sets and console types with an loud speakers the newest ampliphonic muse pets, new Spanish period couples. It was a pewer, and eight take sets, with three dail, in die and the newest and most perular shapes almpilled control. All sets are assembled in all genuine mahagany and walout casing in a choice of eatest types and designs.

5 Tube sets as low as \$34.90 Latest 1927 Models

All Randolph sets are sold at amazingly lowres. No matter what k nd of set you want matter how little you want to pay—you can rety your SET AT YOUR PRICE from the Randolph catalog.

Radio Kits

the piece the following well, known circuits, despite and approved by the world's forement rate engineers. Madison Moore Super. Victories. Super, Silver Marskal Ris., Satyont's Infradynes. Remier Super; Short Ways Kits. Info Line Super; New Arms Reflex; Cockaday, Neutradyne. Browning-Drake and classes of radio frequency, Super Beterodyne and every other approved popular circuit.

Radio Parts and Supplies

The Randolph catalog also contains a most complete line of "B" Battery Riminators, including the famous Bartheon Eliminators: the latest type of Lond Speakers, Cone Speakers, a complete line of quality A power units — in fact, you will find listed in this wonder book every port that goes into the construction of a ratio set, or any accessories you desire, at prices that mean a calculation seving in you.

Free Radio Service

Everyone has need for radio service. The average man has no time to keep up with the rapid developments of radio. We employ Radio Engineers who have made radio their tite work. Their espert advice and helpful suggestions solve every radio problem of our customers.

Our Guarantee

Every article in our catelog is based on sareful laboratory analyses and tests. We guerantee to back up every item in our catelog with our own as well as insunfacturer's assurance of quality.

YOU MUST HAVE THIS BOOK

5 are limitations here prevent our telling you more about the Randolph Catalog. Simply, out and mail the empon—or you may send a postal or letter—and this truly remarkable Radio mok will come to you appoint FREE. MAIL THE COUPON NOW.

Randolph Radio Corporation 150 North Union Avenue Dept. 116 Chicago, III.

Why We Save You Money

Because we handle radio exclusively and sell a tremendous volume of everything in Radio, we can concentrate our buying power for the benefit of our customers.

Volume purchases regulate prices. We command ruck bottom prices from manufacturers, and in many cases we contract for entire factory output of eachieve products. You will benefit by our great volume of purchases and sales, by accuring anything you may want in radio at a substantial saving.

This Coupon Brings the Great RADIO Book FREE

RANDOLPH RADIO CORPORATION 180 N. Umon Ave., Dept. 118 Chicago, Illinote

Send me—free—your 84-page, 1927 Radio
Book.

Name
Street and No._______

Box.

This seal on a radio, tool or oil human advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 4.



Fifteen years ago he was making only \$38 a month!

Success of W. H. Forse, Jr., an amazing tribute to the courage and ability of a man who refused to stay down

TF EVER a man had to fight for success
it was W. H. Forse, Jr.

A. He started as an office boy at \$5 a week and for eight long years after that trind vainly to find the work for which he was best suited.

He clerke in the credit department of the bly & Walker Dry Goods Company of St. Louis . . he sold rope and woosenware . . he even tried conducting a tetail grocery store to a small town.

As a result of the training, Mr. Forse secured a point on as cierk with the Union Traction Company of Anderson, Indiana. He soon showed such mastery of his work that he was made chief bookkeeper, theo acting auditor auditor, assistant treasurer and then secretary treasurer of the Union Traction Company and ten subsidiary corpora ions.

During this period Mr Forse was elerted president of the American Railway Accountants Association, and president of the Central Railway Accountants Association, became a Certified Public Accountant in Indiana, and wrote "Electric Railway Accounting and Auditing."

He also was one of the five accountants who devised the system of accounting now required of all electric railways under the jurisdiction of the Interstate Commerce Commission.

Today Mr. Force is the president of the Force Manufacturing Company president of the Spinaway Manufacturing Company, treasurer of the Matteon Luan Association and treasurer of the Woodlawn Heights Company.

Just the other day he wrote "The training I rere ved from the international Correspondence Schools has helped me greatly in all my undertakings. I know of no other school to well equipped to help ambilious men to get the special training that is so necessary to success to business and industry today."

Thousands of other prominent executives pay similar tribute to the high character of the training they received from the international Correspondence Schools. Jesse G. Vincent, vice-president of the Packard Motor Car Company, is a former I U.S. student, So is Walter C. Alea, persident of the Yale & Lowne Lock Ca. to are Walter P. Chrysier, president of the Chrysier Corporation. J. R. Hall, vice-president of the Chandler Motor Car Company, and E. V. Rickenbacker vice president and director of an ex-of the Rickenbacker Motor Company,

If the L. C. S. can help to smooth the

At least find out how by marking and mailing the coupon printed below. It takes only a moment—it doesn't obligate you is any way—but it may be the means of changing your entire life. "Do it new?"

Mail the Coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS, But 7610-B, Straine, Penna. Without and or obligation, please tell up how I can qualify for the position or in the subject before which I have marked in X QUEINERS TRAINING COURSES TECHNICAL AND INDUSTRIAL COURSES. Reprinces Magazinered. THE REPORT OF THE PARTY OF THE | Electrical Engineering Archibaet. A be ettining
Fersor Leasen
Thom Card Lettering
Strong and Typing
Burners Burlish Industrial Menagement. For manual first in salam Trade Manuscriptor E ert in Lighting Mechanical Engineer Sichteren Blueprints Congractur and Build Sechisetura Deplanan Conerele Ru liber Michaeltai Phafteman Pank of also Remitter Law
Pank of also Remitter Law
Arrestitatory beloning C.F.A.)
Nichtion Cost Arrestitat
Buckherping
Per rate Secretary
New Local Marken Ship Presies netural Engineer Rational Do tomas

Gus Engine Operating

C. It Eng neer

Supregrate and Mapping

21 after an

Steam Kagimaring

Radio Carl Service

RaBear Mail Plott

Contain: Wheel Subject

High School Behjetta

Carleming Chemistry | 1 Applementally Work
Appleme Engions
Nationalism
Applemental
Machinesism * Promise 3544m Address If you swide to Canada, and this coupes to International Correspondence Scients Consider, Limited, Manhred.



A BEAUTIFUL (ONSOLE for YOUR HOME



GENUINE RCA RADIOTRONS

are shipped with Freshman Masterplace Receivers - matched and tested for each individual set. Price with this equipment (one UX 112 Power Tube; one UX 200A Detector Tube; three UX 201A Amplifying Tubes) \$117

FRESHMAN FRESHMAN MASTERPIECE

THEARISTOKRAT

A one-piece Console of finely selected

Genuine Mahogany

One of the finest pieces of furniture in which a radio receiving set has ever been installed. It is truly an aristocrat with its distinctive, finely proportioned lines and rich lustrous finish.

Equipped With the finest of CONE SPEAKERS

especially designed to bring forth the full merit of the new construction of the Freshman Master-piece circuit. Designed for the employment of the new UX-112 Radiotron Power Tube and the necessary "C" battery connection—all metal SHIELDED front and sub-panel.

Sold on easy terms by Authorized Freshman Dealers, who also install and service them

CHAR, FRESHMAN CO., INC., Freshman Building, New York 2012 W. Washington Blvd., Chicago

Write for our beautiful new booklet illustrating and describing our 1927 Receivers and Accessorer

Carrol Int Initially

Worlds Great Radio!

When the Thanksgiving feast is spread—and gay friends gather—when you're joyously thankful for another year of health and plenty—have a Camel!



Camels represent the atmost in cigarette quality. The choicest of Turkish and Domestic tobaccus are blended into Comels by master blenders and the finest of French cigarette paper is made especially for them. No other cigarette is like Camels. They are the averabelising choice of experienced smokers.

WHEN it's Thanksgiving. And your chosen friends are enjoying the good things of earth—here a Came!

For no other cigarette ever gave so much added enjoyment to a Thanksgiving feast. No other was ever so welcome to your friends. Millions of experienced smokers are thankful each day for Camels. This distinctive cigarette brought the world a new measure of smoking satisfaction and contentment, for Camela never tire the taste or leave a cigaretty after-tasto. Before Camel it was impossible to get every good feature in one cigarette.

So this festive day, with thanks for the good year that is gone—send up the fragrant smoke that is loved by millions. On Thanksgiving Day have the best.

Have a Camel!





Our highest trish, if you do not yet know and enjoy Camel quality, it that you may try them. We made you in company Camels with my eigenste made at my price.

It, I haveolde Tabacco Company
Winneys Salam, M. C.



Chesterfield

Such popularity must be deserved

